KU KASETSART UNIVERSITY — FACULTY OF SCIENCE คณะวิทยาศาสตร์

KUSTARS

KASETSART UNIVERSITY SCIENCE
TECHNOLOGY ANNUAL RESEARCH
(KUSTARS)

2023

รวมผลงานวิจัย
ระดับปริญญาตรี

2566

คณะวิทยาศาสตร์
มหาวิทยาลัยเกษตรศาสตร์

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KU FACULTY OF SCIENCE
KASETSART UNIVERSITY คณะวิทยาศาสตร์

โครงการ SciKU Senior Forum 2024:
SciKU Senior Project Symposium 2024
วันที่ 5 เมษายน 2567

นำเสนอโปสเตอร์ รอบที่ 1

(เคมี, เคมีอุตสาหกรรม, สถิติ, ฟิสิกส์)

ณ ลานชั้น 1 อาคารศูนย์วิจัยวิทยาศาสตร์จุฬาภรณ์ 60 พรรษา

เวลาในการติดโปสเตอร์	08.30 – 09.00 น.	
ช่วงเวลาในการนำเสนอผลงาน	09.15 – 10.00 น.	นำเสนอ Poster รอบที่ 1
เวลาในการเก็บโปสเตอร์	10.15 – 10.30 น.	

นำเสนอโปสเตอร์ รอบที่ 2

(วิทยาศาสตร์พื้นพิภพ, วิทยาศาสตร์นิวเคลียร์, ชีวเคมี)

ณ ลานชั้น 1 อาคารศูนย์วิจัยวิทยาศาสตร์จุฬาภรณ์ 60 พรรษา

เวลาในการติดโปสเตอร์	10.30 – 11.00 น.	
ช่วงเวลาในการนำเสนอผลงาน	11.15 – 12.00 น.	นำเสนอ Poster รอบที่ 2
เวลาในการเก็บโปสเตอร์	12.10 – 12.25 น.	

นำเสนอโปสเตอร์ รอบที่ 3

(วิทยาศาสตร์ชีวภาพรังสี, จุลชีววิทยา, พฤกษศาสตร์, วิทยาศาสตร์ชีวภาพและเทคโนโลยี)

ณ ลานชั้น 1 อาคารศูนย์วิจัยวิทยาศาสตร์จุฬาภรณ์ 60 พรรษา

เวลาในการติดโปสเตอร์	12.25 – 12.50 น.	
ช่วงเวลาในการนำเสนอผลงาน	13.00 – 13.45 น.	นำเสนอ Poster รอบที่ 3
เวลาในการเก็บโปสเตอร์	13.55 – 14.10 น.	

นำเสนอโปสเตอร์ รอบที่ 4

(ชีววิทยา, สัตววิทยา, พันธุศาสตร์, วิทยาการคอมพิวเตอร์, คณิตศาสตร์)

ณ ลานชั้น 1 อาคารศูนย์วิจัยวิทยาศาสตร์จุฬาภรณ์ 60 พรรษา

เวลาในการติดโปสเตอร์	14.15 – 14.30 น.	
ช่วงเวลาในการนำเสนอผลงาน	14.45 – 15.30 น.	นำเสนอ Poster รอบที่ 4
เวลาในการเก็บโปสเตอร์	15.40 – 16.00 น.	

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Poster Session IV

Transition Metal Dichalcogenides (TMDs) Composite as heterostructural electrocatalyst for hydrogen evolution reaction

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Currently, hydrogen gas (H_2) plays a crucial role in development of applications in industry and vehicles due to its clean energy nature. In this work, we explored the development of highly efficient catalysts for the hydrogen evolution reaction (HER) using various transition metal dichalcogenides (TMDs) such as MoS_2, $MoSe_2$, and WSe_2. It was found each TMDs heterostructures could be potentially used to replace expensive platinum (Pt) catalysts for HER. Moreover, we found the $MoSe_2$ and WSe_2 composites (75:25 %mass ratio) performed the excellent HER performances due to its low overpotential of – 0.47 V (vs. RHE) at 10 mA/cm^2 and Tafel slope have 104.9 mV/dec. In addition, we tested the stability of the optimized $MoSe_2$/WSe_2 composites after 5000 cycles, demonstrating long-term use for HER. Therefore, the use of TMD composite could be potential for catalyst-based HER applications.

Keywords: Transition Metal Dichalcogenides, Catalysts, Hydrogen Evolution Reaction

Electrospun Nanofibers of Alpha-Mangostin/Cyclodextrin Inclusion Complex as Carriers for Transdermal Delivery System

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Electrospun nanofibers containing an inclusion complex of alpha-mangostin and hydroxypropyl-β-cyclodextrin (α-M/HP-β-CD) were developed for fast-dissolving drug delivery system. Alpha-mangostin (α-M) is an effective antibacterial xanthone compound which suffers from limited water solubility. However, this limitation of α-M could be eliminated by forming inclusion complex with cyclodextrins. In this study, hydroxypropyl-β-cyclodextrin (HP-β-CD) was used as complexation agent and the inclusion complex was synthesized by using α-M and HP-β-CD in the mole ratio of 1:1. The formation of α-M/HP-β-CD inclusion complex was confirmed using ATR-FTIR analysis. The water solubility of α-M from the α-M/HP-β-CD complex analyzed by UV-Vis spectrometry was about twelve times higher than that of pure α-M compound. The fast-dissolving nanofibers containing α-M/HP-β-CD complexes were then fabricated using electrospinning technique. Polyvinyl pyrrolidone (PVP) and sacran, a naturally-derived polysaccharide, were used as electrospinning matrix. Sacran has drawn a great attention and been widely used as an ingredient of cosmetic products due to its high water-retention properties and anti-inflammatory characteristics. The fabrication conditions were studied and adjusted to obtain uniform and continuous nanofibers with fast water-dissolving properties. SEM results showed that the nanofibers fabricated from the polymer mixture of 10% w/v of PVP and sacran at the volume ratio of 95:5 in ethanol/water system were uniform, continuous and bead-free. The water-solubility test of the obtained nanofibers showed that the PVP/sacran nanofibers was fast and completely dissolved in water, indicating an enhancement of water solubility and wettability. Then, the α-M/HP-β-CD complexes at 10% (w/w, with respect to PVP weight) were successfully incorporated into the nanofibers. *In-vitro* release study by UV-Vis spectrometry revealed that the PVP/sacran nanofibers containing 10%w/w of α-M/HP-β-CD complex released highest concentration of α-M at about 8 %w/w within 4 minutes. This study demonstrates a great potential of using the PVP/sacran nanofibers containing α-M/HP-β-CD inclusion complexes for cosmetic applications and fast-dissolving delivery system.

Keywords: Electrospinning, Alpha-mangostin, Inclusion complex, Cyclodextrin, Sacran, Nanofibers, Polyvinyl pyrrolidone

Synthesis of an α-glucosidase inhibitor α-1-*C*-butyl LAB from D-xylose

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This project aims to study and develop a novel green synthetic method for an anti-α-glucosidase, α-1-*C*-butyl LAB using a naturally occurring, abundant and low-cost D-xylose as a substrate. The key steps involve imine formation, nucleophilic addition to imine and intramolecular substitution of -OH group (S_N2 reaction). We obtained pyrrolidine **2′** which is a diastereomer of the desired pyrrolidine **2** in 5 steps from D-xylose due to addition of Grignard reagent to imine **4** provided amino alcohol **3′** instead of **3**. Treatment of **3′** with phosphinic acid (H_3PO_2) promoted an intramolecular S_N2 reaction to give pyrrolidine **2′** as a single diastereomer.
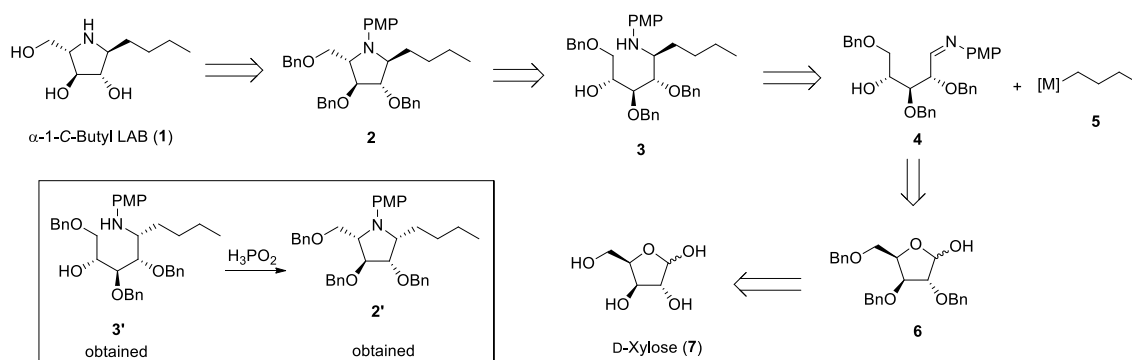
Keywords: α-1-*C*-Butyl LAB, alpha-glucosidase enzyme, xylose

Detection of dopamine by Ni/rGO/ PDDA modified screen-printed carbon electrode

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Dopamine is a brain chemical that plays a critical role in controlling attention, enjoyment, pleasure, and the body's visual system. If the body lacks dopamine or has excessively low dopamine levels, we may encounter health problems and abnormal behaviors. For example, perception and memory functions may deteriorate. Most elderly people develop Parkinson's disease due to this reason. Hence, it is necessary to measure dopamine levels for the health and well-being of the population, especially the elderly and those with problems related to decreased dopamine levels. In the present research, dopamine was measured by using a Ni/rGO/PDDA modified carbon screen-printed working electrode using cyclic voltammetry, differential pulse voltammetry, and impedance spectroscopy techniques. It was found that the electrode has excellent electrochemical performance and high sensitivity. The modified electrode can detect dopamine in a wide concentration range of 2 to 10 µM and 10 to 80 µM, with a limit of detection (LOD) of 0.00199 µM and 0.00198 µM, respectively. The electrode shows high selectivity and reproducibility towards dopamine.

Keywords: dopamine, screen-printed carbon electrode

Virtual screening for acetylcholinesterase inhibitor from Thai remedies "Suksaiyas"

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Nowadays, it currently has a progressively older population in the worldwide. The physical health issues and numerous ailments, particularly Alzheimer's disease (AD), are mainly concerns. The most prevalent type of dementia involves with the brain's nerve cells deteriorating. The breakdown of neurotransmitters, such as acetylcholine, by acetylcholinesterase (AChE) is a reason for causing the dementia. Acetylcholine is crucial for memory and the nervous system. The deficiency of acetylcholine causes AD to worsen. For this reason, the potent AChE's inhibitors are required. In this study, the active ingredient of Suksaiyas medicine recipe are interested in to look for the compounds which can be potent AChE's inhibitors. Virtual Screening method through computational chemistry is applied to search for the binding orientation between ligand and AChE. At first, the structures of the active ingredient of Suksaiyas medicine recipe were geometricaliy optimized. Then, the binding orientations of these ligands in the binding site of AChE were performed using GOLD molecular docking and goldscore was used as scoring function to select the best candidate for the binding. After that, drug-like properties and physicochemical properties were determined using the swissADME website. The results showed that vitamin K might be the good candidate for the binding. Molecular dynamics simulations were then performed to obtain the equilibrate structure about 100 ns. The analysis of root-mean-square deviation (RMSD) and root-mean-square fluctuation. (RMSF), radius of gyration (Rg), number of hydrogen bonds, and cluster analysis were determined. The results leads to the conclusion that vitamin K derived from cannabis might be the good candidate for AChE' disease. The results will be helpful for the development of AChE' inhibitors in the future.

Analysis of active compounds from *Alpinia galanga* rhizome extracts

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A study of solvents for the extraction of *Alpinia galanga* rhizomes to obtain the highest amount of bioactive compound, 1'-acetoxychavicol acetate (ACA*)*. The dried rhizomes of *A. galanga* were sequentially extracted using maceration over 3 days using hexane, dichloromethane, ethyl acetate, and ethanol. The plant was also extracted with ethanol over 7 days. The sequential extraction with ethanol gave the highest yield (3.59%), followed by hexane (3.48%). The extracts were then analyzed for the quantity of ACA using HPLC. The results found that the ethanol extract obtained from sequential extraction showed the highest amount of ACA with 7.37%, followed by the ethanol extract (D) with 5.86%.

Keywords: *Alpinia galanga*, 1'-acetoxychavicol acetate, Extract, HPLC

A Study of Facile Extraction Methods Suitable for Surface-Enhanced Raman Spectroscopy (SERS) Detection of Paraquat in Soil Samples

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Paraquat is an herbicide known for its high toxicity to human health and the environment. This study aims to develop a simple extraction method suitable for detecting paraquat in soil samples using Surface Enhanced Raman Scattering (SERS) technique. Three types of soil samples were investigated, including sandy soil, loamy soil, and clay soil. The study employed Quick, Easy, Cheap, Effective, Rugged, and Safe (QuEChERS) principle for extraction. The investigation explored the optimal solvent conditions for detecting low concentrations of paraquat using two types of SERS chips developed by the National Electronics and Computer Technology Center (NECTEC): "ONSPEC-Prime" and "ONSPEC-Lite". The results revealed that the optimal extraction solvents varied depending on the chip type and the soil type. For the ONSPEC-Prime, the most suitable extraction solvents were buffer solution (0.1 M NH_4OH + 1% formic acid at pH 5), ultrapure water, and 1M HCl. For the ONSPEC-Lite, the buffer solution and ultrapure water were found to be optimal. Paraquat in sandy soil could be easily extracted, while loamy soil and clay soil required extraction under alkaline conditions. Thus, pH of the final extracts had to be adjusted prior to paraquat detection using the SERS chips. Preliminary studies have shown that the ONSPEC-Lite yielded more precise paraquat signals when compared to the ONSPEC-Prime. The experimental lowest detection limit was 0.8036 mg/L. Overall, this project demonstrates the importance of tailoring extraction methods for different soil samples and varied SERS chips. The proposed method herein allows efficient extraction and paraquat detection with ease-of-use, rapidity, and high sensitivity. This work lays a crucial foundation for developing efficient extraction and measurement methods for analyzing various toxic substances in complex environmental samples.

Keywords: Paraquat, Soil, QuEChERS, SERS, Sample preparation

Development of ZnO nanorods for a catalyst in electro synthesis of urea

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Urea, a substance applicable in agriculture for urea fertilizer production due to its high nitrogen content, enhances plant growth by providing essential nutrients. Traditional synthesis methods like the Bosch–Meiser process requires high costs, energy consumption, and also create significant amount of environmental pollution. This study explores alternative methods for synthesizing urea by an electrochemical reduction from CO_2 and NO_3^-. Zinc was widely used to catalyze such reaction; however, achieving the optimal efficiency still post a strong challenge. In this work, we found that the dimensions of zinc oxide nanorods increase during hydrothermal reaction, correlating, to a certain degree, with enhanced Faraday efficiency in urea synthesis. Nonetheless, the urea production efficiency peaks at a specific length of zinc oxide nanorods, suggesting potential for optimizing zinc oxide nanorods structures, such as, rods height, length density and level of dopants could hypothetically improve electrochemical urea synthesis for sustainable agricultural practices.

Synthesis of Copper (II) Ion Complexes for Sensing Antibiotic Applications

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Currently, the increasing problem of antibiotic resistance poses a difficulty to medical treatment. This is due to the widespread use of antibiotics in disease treatment and livestock. When the body is receives to antibiotics directly or antibiotics residue in the environment for extended periods, bacteria in the body can develop antibiotic resistance. Based on the problem, this research has synthesized and studied four types of sensors including copper ions complex and organic compound, namely CuAB MOF, CuAS MOF, CuA complex, and adenine. (A = adenine, B = Biphenyl-3,3',5,5'-tetracarboxylic acid, S = succinic). They show fluorescence properties at λ_{em} 405 and 425 nm (when λ_{ex} = 350.9 nm). They were studied for detection antibiotics by using quenching of fluorescence. From the study, it was found that all four types of sensors was specific to detected Nitrofuran antibiotic, including Nitrofurazone (NFZ) and Nitrofurantoin. Percentage fluorescence quenching are 99.90%, 98.09%, 59.83% and 89.02% for NFZ, and 98.57%, 98.07%, 59.89% and 88.24% for NFT, respectively. CuAB MOF, CuAS MOF, CuA complex, and adenine exhibit Stern-Volmer constant (K_{SV}) are 3.816×10^4, 5.979×10^4, 1.680×10^4 and 7.377×10^4 M^{-1} for NFZ, respectively. And the K_{SV} values of CuAB MOF, CuAS MOF, and adenine are 4.425×10^4, 5.882×10^4 and 6.236×10^4 M^{-1} for NFT, respectively. Furthermore, the limit of detection (LOD) of CuAB MOF, CuAS MOF, CuA complex, and adenine are 0.0939, 0.1357, 0.9657 and 0.0304 ppm, respectively. And the LOD of CuAB MOF, CuAS MOF, and adenine are 0.1472, 0.1099 and 0.0369 ppm, respectively. The fluorescence quenching of NFZ and NFT is dependent on fluorescence resonance energy transfer (FRET) and the photoinduced electron transfer (PET) process.

Keywords: Antibiotic, Metal Organic Framework (MOF), Fluorescence, Sensor, Nitrofuran, Adenine

Synthesis, Structural Modification, and Biological Activity Evaluation of Triazole Derivatives Derived from *S*-Benzylhomocysteines

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Triazoles are pentagonal heterocyclic aromatic compounds consisting of three nitrogen and two carbon atoms. Their structure allows them to bond with the various enzymes and cellular receptors. Therefore, the compounds containing triazole ring are popular in studying in biological evaluations for treatment of several diseases.

This research focuses on the synthesis of 1,2,3-triazole derivatives via the copper(I)-mediated Click reaction from, modified *S*-benzyl homocysteine azido derivatives and propargyl quinazolinone. The yield of the synthetic products was varied from low-high range (12-82%) depending on the substituents on the aromatic ring.

Keywords: 1,2,3-Triazole, Click reaction.

Synthesis of hinokithiol derivatives and their inhibitory effect on tyrosinase enzyme activity

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Hinokitiol ester derivatives were synthesized via an esterification reaction. Five carboxylic acids, *trans*-cinnamic acid, benzoic acid, 3,4-methylenedioxycinnamic acid, *m*-toluic acid and *p*-hydroxycinnamic acid, were reacted with hinokitiol using triphenylphosphine (PPh_3) and carbon tetrabromide (CBr_4) under an argon atmosphere to produce hinokitiol derivatives. The yield of the desired products was found in the range 9-59%. Following synthesis, the derivatives were evaluated for their tyrosinase inhibitory activity. All synthesized compounds showed excellent inhibition at a concentration of 100 µM.

Synthesis of Ceramide IIIB, a Natural Skin Protective Lipid Barrier, from a Commercially Available Boc-Ser-OMe

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Ceramides are a component of the skin layer that shows important in maintaining the structure of skin cells. They have the potential to be used as medicines and skincare product. In this research, we focused on the synthesis of Ceramide IIIB via 9 step synthesis. The commercial available protected serine, Boc-Ser-OMe, was used as a starting material. Cyanohydrin formation, Grignard reaction and *N*-acylation were used as key reactions.

Keywords: Ceramides, cyanohydrin formation, Grignard reaction, *N*-acylation

Synthesis of 3-methoxy-2-methyloxoquinoline

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Waltherione C, a naturally occurring compound isolated from *Melochia odorata*, has exhibited significant anti-HIV properties. Our current research aims to synthesize 3-methoxy-2-methylquinolinone, the core structure of waltherione C, starting from 2-nitrobenzaldehyde through a meticulously planned six-step process. Progressing through the synthesis, we have successfully completed the initial two steps. Firstly, the formation of the epoxide was achieved with a moderate yield (49%). Subsequently, the ring-opening reaction of the epoxide was accomplished with a good yield (72%).

Synthesis of cyclodextrin conjugated fluorescein dye for drug delivery tracking

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In this research, cyclodextrin conjugated fluorescein was synthesized for UV absorption or fluorescence emission tracking agent. The synthesis was done in two steps. In the first step, fluorescein sodium salt was reacted with cyanuric chloride to obtain FL-Cy. Then FL-Cy was reacted with HP-b-CD to obtain CDF. The chemical structures were characterized by using ^{1}H-NMR, IR and MS. The UV absorption and fluorescence emission of CDF was studied by using UV-Vis and fluorescence spectroscopy. The results showed that CDF showed absorption band at 450-490 nm and emission band at 513-519 nm similar to fluorescein sodium salt. The inclusion complex of resveratrol:CDF has been prepared. It was found that the encapsulation efficiency of resveratrol:CDF was maximum at 7.26 % without changing of absorption and emission profile of CDF. This system can be used as a drug delivery agent in the biological system.
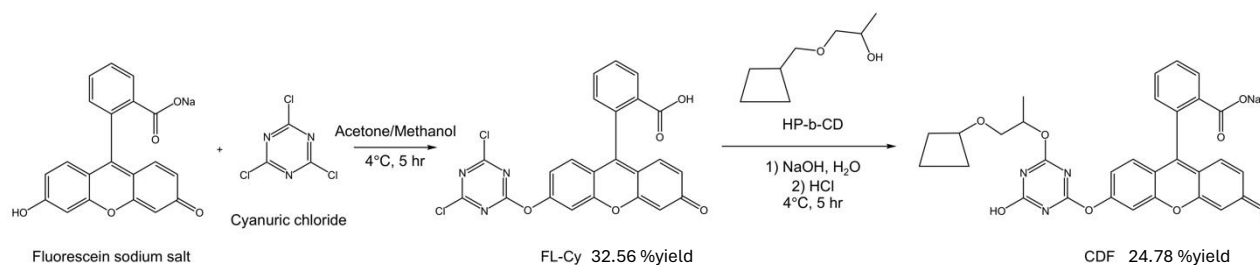
Figure 1. Synthesis scheme of CDF.

Keywords: Synthetic pathway of CDF.

Synthesis of substituted piperidine ring as a core structure of antimalarial drug, halofuginone from D-Serine

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(+) - Halofuginone is an modified structure of natural occurring antimalarial (+)-Febrifugine. This compound shows a higher efficacy with less toxic than the febrifugine. The structure of halofuginone contains 2 main parts which are a chiral piperidine ring and a quinazolinone ring. In this research, we aimed to synthesized the piperidine ring starting from *N*-Boc-D-serine methyl ester. The 10-step synthesis was planned and the overall yield was obtained in 4.62%. The ruthenium–catalyzed oxidative cleavage and Horner-Wadsworth-Emmons reaction were used as key reactions.

Keywords: piperidine ring, *N*-Boc-D-serine methyl ester, halofuginone, ruthenium–catalyzed oxidative cleavage, Horner-Wadsworth-Emmons

Study of chemical constituents of hydrosols from aromatic plants

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Hydrosol is a product obtained along with essential oils, which are a group of volatile and semi-volatile organic compounds, whose properties contribute to the aroma of the source (typically a plant). EOs and Hydrosols are derived from various plants and different parts of those plants, such as rhizomes (ginger), flowers (jasmine), leaves (patchouli), bulbs (garlic), barks (cinnamon), fruits (lemon), seeds (cumin), dried flower buds (clove), and grasses (lemongrass). Hydrosols, also known as flower or aromatic water from extraction techniques, are a complex mixture mostly used in cosmetics containing volatile oils and other water-soluble compounds. They are often misclassified as wastewater and discarded despite containing valuable bioactive components. In this work, the chemical compositions of hydrosols produced from six different aromatic plant species, lime peels (*Citrus aurantifolia*), lemon peels (*Citrus limon*), lemongrass stems (*Cymbopogon citratus*), jasmine flowers (*Jasminum Sambac*), pandan leaves (*Pandanus amaryllifolius*) and honey tangerine peels (*Citrus reticulata*) by water-distillation were investigated. The compositions of hydrosols were determined using gas chromatography-mass spectrometry (GC/MS). The results found that the major components were *trans*-citral (20.55%), *cis*-citral (17.83%) and terpineol (13.41%) for lime peels, (*R*)-citronellol (11.88%) and terpineol (10.50%) for lemon peels, *trans*-citral (55.20%) and *cis*-citral (10.18%) for lemongrass stems, linalool (16.08%), indole (13.44%), and butyl acetate (10.72%) for jasmine flowers, butyl acetate (17.44%) and toluene (12.20%) for pandan leaves and butyl acetate (17.07%) and toluene (14.52%) for honey tangerine peels. Furthermore, tyrosinase inhibitory activity of hydrosols is in progress.

Keywords: Hydro-distillation, Hydrosol, GC/MS, Tyrosinase inhibitory activity

Analysis of Nutritional Values of Meat for Future Food Design

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Recently, the demand for meat consumption has been increased every year. Dry-aging meat becomes more demanded due to its better taste and flavor. Herein, the nutrition analysis was performed on commercial dry-aging beef and buffalo meats in comparison to pork meat. The protein and collagen contents and physical and chemical properties were investigated here. The cooking loss, shear force, and microstructure of fiber were also determined in order to explore the meat taste and texture. The results showed that there is no significant difference in protein contents among all meats (926–946 mg/g), but beef and buffalo showed slightly higher myofibrillar protein content. This is related to the higher pH of beef and buffalo meat found (pH range of 5.63-5.78). On the other hand, pork has a lower pH (pH 5.12) which means pork is more acidic due to this is in the Pale Soft and Exudative meat (PSE) condition. For the analyzed collagen, because beef and buffalo meat were caused by dry aging where the connective tissue was proteolysis. This is in a good agreement with the SEM images. Considering the size and density of the muscle fibers, both beef and buffalo have higher fiber density relating to the high shear force (79.10±14.65 N–60.55±8.68 N) and high %cooking loss (28.68 ± 1.61–24.78 ± 2.04). Overall, the results reveal that buffalo meat has similar nutrition compared to beef which can serve as alternative meat.

Keywords: Buffalo meat, Beef, Meat quality, Nutritional value

Metabolomics study of coffee processing methods as a tool for developing coffee products

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This research aims to investigate the metabolomics of coffee beans subjected to different processing methods. The Head space solid-phase microextraction/gas chromatography-mass spectrometry (HS-SPME/GC-MS) was employed to explore the comprehensive flavor profiles of various coffee processing methods, including dry, wet, and honey processes. Among 20 different compositions identified, 11 were found to be consistent across all methods. The analysis revealed benzylchloride, ethoxybenzene, o-cymene, styrene, ethanol, and 3-methyl-butanoic acid as the primary volatile compounds. Notably, the chemical composition of the dry process exhibited minimal diversity compared to the other methods. This observation suggests that prolonged exposure to sunlight during the dry process may contribute to the depletion of certain components within the coffee beans. Interestingly, styrene was found to be the most abundant compound in the dry process, contributing to its distinct aroma and taste profile. These findings shed light on the impact of different processing methods on the chemical composition of coffee beans, providing insights for coffee industry professionals and enthusiasts alike.

Keywords: Metabolomics Authenticity, Headspace solid phase Gas chromatography/mass spectrometry (HS-SPME GC-MS), Coffee Processing.

Analysis of Carnosine and Anserine from the Black Chicken Nin-Kaset by High Performance Liquid Chromatography (HPLC)

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Nin-Kaset black-boned chicken bred was developed by Tropical Animal Genetic special research Unit (TAGU), Kasetsart University. It is well known that black chickens have high nutrition and high levels of carnosine (CAR) and anserine (ANS) dipeptides. These compounds are key bioactive compounds showing a wide range of therapeutic properties and are found in the skeletal muscle and nervous system in many vertebrates. However, it is difficult to quantify their exact amount because they are analogs. A specific and sensitive condition is required. Thus, in this work, the quantitative strategies and conditions were studied to analyze CAR and ANS contents in white feather Nin–Kaset (W) and black feather Nin–Kaset (B) in comparison to Baytong chicken (T) using high performance liquid chromatography (HPLC) with Asahipak NH2P-50 4E (4.6 x 250 mm) column and NaH_2PO_4/ACN: 45/55 mobile phase performed at ambient temperature. The photodiode array detector was set at 210 nm. The more convenient and simplified techniques were discovered. The CAR and ANS compounds were extracted under acidic solution and stabilized at pH 5.0. The highest CAR and ANS concentrations of 1.59 and 6.82 mg/g were found in Baytong chicken, while black feather Nin–Kaset feed with addition insects into chicken feed shows the highest content of CAR and ANS, (3.03 and 8.37 mg/g). In this work, not only CAR and ANS contents of native Nin-Kaset chicken was revealed in comparison to local chickens, but the more convenient quantitative methods and conditions to identify CAR and ANS concentrations were also reported.

Keywords: Black chicken; carnosine; anserine; HPLC; healthy food; future food

Improvement of the sample preparation process for Raman measurements of coffee samples and development of the related extraction kit

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This work aims to improve sample preparation procedures for coffee analysis using Raman spectroscopy and develop an extraction kit for real-world applications. The study focuses on applying and optimizing a coffee sample extraction method using the QuEChERS approach, which is fast, economical, and safe. The extracted samples are then analyzed by using Raman spectroscopy with the goal of predicting the roast level of the coffee samples. The study compared the performance of 3 extraction recipes, including "Original", "AOAC", and "EN". The results revealed that the "Original" method provided the highest prediction accuracy of 90%. Additionally, 6 sorbent formulas were tested, and the combination of $MgSO_4$, PSA, and C18 was found to be the most suitable recipe for removing matrix interferences. We also investigated other factors that may influence the extraction process, such as the centrifugation time, where 5 minutes is determined to be the optimal duration. Moreover, the study also emphasized the importance of proper sample storage. The developed method herein enabled clear detection of Raman signals from the coffee extracts at important Raman shifts, such as 555 cm^{-1}, 741 cm^{-1}, 1328 cm^{-1}, and 1602 cm^{-1} which are significant for accurately predicting the roasting level of the coffee samples. Based on the above findings, we designed a suitable packaging for the extraction kit. The packaging helped to extend the shelf life of the extraction kit and made the kit easier to use, resulting in more consistent results. This research demonstrates an approach to optimize sample preparation process and to develop extraction kit for coffee analysis using Raman spectroscopy. The findings can be adapted and further developed for various real-world applications.

Keywords: Raman spectroscopy, sample preparation, extraction kit, coffee, roast level

Determination of collagen content in black chicken meat of the Nin-Kaset

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A partial substitution of poultry meal with insect has globally increased much attention because of the limited availability and high cost of conventional feed resources. The objective of this study was to determine the effect of partially substituted poultry meal with insects on the collagen contents of meats in indigenous Nin-Kaset black chicken (both black-feathered and white-feathered), then compared with indigenous Betong at the age of 11 and 16 weeks. Our results revealed that the poultry meal partially substituted with insects showed significantly affect the collagen contents of the white feathered Nin-Kaset in the drumsticks meat and black-feathered Nin-Kaset in the wings meat at both age of 11 and 16 weeks by being found the higher amount of collagen compared to normal feed. While the collagen contents in other meat parts of white feathered and black-feathered Nin-Kaset did not significantly affect by diet substitution compared to normal feed. In our study, the collagen contents in black-feathered Nin-Kaset was found higher than white-feathered Nin-Kaset which were 1.06, 3.23, 5.27, and 6.59 mg/g for breast, thighs, drumstick, wings, respectively. Moreover, at 16 weeks of age, the collagen content of white-feathered and black-feathered Nin-Kaset meat was lower than that of Betong chickens when raised with insect substituted meal. Thus, this suggested that insects partially substituted poultry meal could substitute the conventional dietary for Thai indigenous chickens of Nin-Kaset black. We hope that This research could develop genetic potential for raising Nin-kaset chickens and determine a valuable local chicken recipe to create premium agricultural products. Therefore, it expands the market for agricultural products and agricultural product lines based on basic research.

Keywords: Collagen contents, Black-feathered Nin-Kaset chicken, White-feathered Nin-Kaset chicken, Betong chicken

MS-based Metabolomics of Duckweeds

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Wolffia also known as duckweed, is a genus of aquatic plants that humans can consume. It is rich in nutrients such as amino acids, flavonoids, and antioxidants. Wolffia typically grows in quiet natural water sources, and its nutritional value varies depending on the environmental conditions for growth. We are interested in studying the metabolomics of Wolffia under controlled conditions with different concentrations of NaCl over a period of 7 days. From the experiments, it was found that the color of Wolffia cultivated under normal conditions is fresh green, differing from Wolffia cultivated with varying concentrations of NaCl, which gradually becomes paler. When analyzed using LC-QTOF technique, the majority of metabolites found in all concentrations were flavonoids. Comparing the quantities of flavonoids at each concentration, it was found that the amount of flavonoids did not change. Therefore, the color variation in Wolffia did not originate from the quantity of flavonoids found, and the concentration of NaCl did not affect the quantity of flavonoids in Wolffia. However, it did affect the color of Wolffia. The exact cause of the color change in Wolffia has yet to be determined in this research.

Keywords: Wolffia, Metabolomic, Salt

Preparation of higher value-added carbon materials
from agricultural waste

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Currently, there are enormous attention in a research interest of the conversion of agricultural waste into higher value-added carbon nanomaterials. Lignin, one of the three main components of lignocellulosic biomass, has many attractive properties such as low price, high carbon contents, high aromaticity, and abundant oxygen functional groups that offers as a valuable precursor for various carbonaceous materials. In this work, we transform lignin into nanocarbon materials via a pyrolysis process at 900 °C under N_2 atmosphere with the presence of $FeCl_3$ and urea as catalysts to increase the adsorption efficiency. The properties of lignin derived carbon were characterized by FTIR, Raman, SEM/EDS, BET analysis and then used as an adsorbent for the removal of methylene blue (MB). The results showed that the lignin derived carbon has an increase of surface area to 868.20 m^2/g with an adsorption capacity of MB at 185mg/g at 3h when urea is added in the pyrolysis process. Our lignin derived carbon materials could be a low cost, high effective for methylene blue treatment in wastewater.

Keywords: Lignin, Carbon nanomaterials, Methylene blue, adsorption

Preparation of nanocellulose-based adsorbents and application in wastewater treatment

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Ineffective treatment of water from industrialized processes leads to the contamination of various pollutants in wastewater, especially heavy metals. These heavy metals not only harm the ecosystem but also pose serious health risks. Therefore, it is crucial to develop effective methods for their removal. This research primarily focused on the design and fabrication of a nanocellulose-based hydrogel for heavy metal adsorption. The hydrogels were synthesized using cellulose nanofibers derived from TEMPO-mediated oxidation, followed by defibrillation (TOCNF), along with carboxymethyl cellulose (CMC) and polyvinyl alcohol (PVA), and chemically crosslinked using glutaraldehyde. Bentonite, an inorganic additive, was also incorporated to enhance strength and surface area of the hydrogels. The as-prepared hydrogels were analyzed using Scanning electron microscopy (SEM) and Fourier-transform infrared spectroscopy (FTIR). The adsorption capacities of the resulting hydrogels for Cu^{2+} were evaluated using Atomic Absorption Spectroscopy (AAS). Various factors affecting Cu^{2+} adsorption, such as pH , time , Cu^{2+} concentration, and bentonite ratio, were examined to determine the optimal conditions for maximum Cu^{2+} adsorption. Further studies will investigate the hydrogel's potential for reusability. In addition, initial results regarding the adsorption of cationic MB dye revealed selective adsorption of cationic dye over anionic dye. These findings highlight the significant potential of the synthesized hydrogels in wastewater treatment application.

Keywords: cellulose, hydrogel composite, chemical crosslink, adsorption, copper (II) ion

Preparation of Biofilm from Seafood industry Waste and Metal-Organic Framework for Application in Delaying the Ripening of Fruits

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This research investigates the extraction of chitin from squid pens, which are waste materials from the seafood industry, through the processes of deproteination and demineralization. The obtained chitin is then synthesized into chitosan through deacetylation, resulting in a chitosan yield of 6.249%. The successful synthesis of chitin and chitosan was confirmed using Fourier Transform Infrared (FTIR) Spectroscopy and Thermogravimetric Analyzer (TGA) techniques.

The synthesized chitosan was utilized to prepare chitosan film mixed with a metal-organic framework (MOF) material called ZIF-8. Three types of ZIF-8 were studied for mixing with chitosan to form films: nano ZIF-8, micro ZIF-8, and micro ZIF-8/Zeolite. It was found that nano ZIF-8 with nanoscale dimensions could be effectively mixed with chitosan to form films, with a maximum mixing ratio of 33.33% by weight (chitosan+ZIF-8). The prepared ZIF-8@Chitosan films were then studied for their ability to adsorb ethylene gas released during the ripening process of bananas.

The results showed that the chitosan film with the highest amount of ZIF-8 had the greatest ability to adsorb ethylene gas, thus delaying the ripening of bananas. This suggests that chitosan films mixed with ZIF-8 have the potential to be used for ethylene gas adsorption to prolong the shelf life of fruits.

However, to enhance the efficiency of chitosan films in gas adsorption, further research and refinement of chitosan synthesis methods in various formats are necessary to increase the surface area for MOF encapsulation. This will be essential for future applications in fruit ripening delay.

Keywords: Chitin, Chitosan, Biofilm, ZIF-8, Ethylene adsorption

Efficiency comparison of interval estimation methods for parameter of Poisson distribution

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The objective of this research comparison of three interval estimation methods, namely Adding the Tail Probability of the Confidence (AWC), Garwood (GW), and Bégaud (BB) methods, for Poisson parameter. The performance comparison criteria are the confidence coefficient validation and average width of the confidence interval. Random sample data are simulated the Poisson distribution with parameter λ. Three levels of sample size (n) are studied as follows: small (n=10, 15, 20), medium (n=30, 40, 50), and large sample sizes (n=100, 300, 500). The parameter (λ) is defined as 0.3, 0.5, 0.7, 1, 3, 5, 7, and 9. Total of 72 scenarios are studied and repeated 2,000 times for each scenario. The research results are summarized as follows: The AWC method tends to have a good performance for almost all levels of parameter (λ) and sample sizes. The BB method tends to have a good performance when the sample sizes are 40 and 100 for the parameter (λ) as 0.3. For a small sample size and parameter (λ) is not greater 1, the GW method tends mostly to have a good performance.

Comparing the efficiency of adaptive Circular Systematic Sampling and Bilinear Systematic Sampling.

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The purpose of this research were to study and compare the efficiency of adaptive circular systematic samplings. They composed of the Modified Balance Circular Systematic Sampling (MBC), Modified Circular Systematic Sampling (MCC), Modified Systematic Sampling (MSS) and Bilinear Systematic Sampling (BSY). The simulated data was generated with the linear model by SAS 9.4. Population size were 1500 1000 700 500 and 250. The sample sizes were defined into three groups; large, medium and small based on percentage 25 20 15 and 10 of the population size. The efficiency of four sampling methods was compared by using mean square error (MSE) and relative efficiency (RE). The result showed that the sample mean from MBC have the minimum MSE. The MSE of MCC and BSY were lower than the MSE of MSS all situations. The RE of MBC and MCC were more efficiency than MSS all situations and the efficiency of BSY are similar to MSS.

Keywords: Circular systematic sampling; Modified circular systematic sampling; Modified systematic sampling; Bilinear systematic sampling.

The impact of knowledge and attitude on protective behavior of sexually transmitted disease among university students in Bangkok

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The purpose of this research was to study knowledge and attitude on protective behavior of sexually transmitted disease in undergraduate students The research tool was a questionnaire, consisting of 4 part : 1. General information, 2. Knowledge and understanding of sexually transmitted disease, 3. Assessment form for Sexual Attitude, 4. preventing behaviors of sexually transmitted disease. Descriptive statistics used were percentage, mean and standard deviation. logistics Regression analysis and Random forest was used to assess the association between factors and prevention behavior of sexually transmitted disease and studying factors affecting sexually transmitted disease. Using Logistic Regression Analysis, the results revealed that factors affecting sexually transmitted disease prevention behaviors were gender, sexual orientation, have received information and knowledge about sexually transmitted diseases and attitudes about preventing sexually transmitted diseases with a statistical significance level of 0.05.

Keywords: Attitude, Behavior, Knowledge, Sex, Understanding

Forecasting models for electricity consumption in Thailand

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The purpose of this research was to construct the monthly electricity consumption forecasting model, compare three forecasting methods and forecast the electricity consumption in Thailand. The electricity consumption is divided into four types, which are residential, small general service, medium general service, and large general service. The monthly electricity consumption data of 144 values from January 2011 to December 2022 were used and divided into 2 sets. The first dataset with 132 values from January 2011 to December 2021 was used to construct the forecasting models and validate of the forecasting models to compare three forecasting methods, which are Holt-Winters exponential smoothing method, Decomposition method and Box-Jenkins method using SARIMA and SARIMAX model, by considering Akaike information criteria, Bayesian information criteria and root mean square error. The second dataset with 12 values from January 2022 to December 2022 was used for comparing the accuracy of the forecasting model by considering root mean square error and mean absolute percent error. The result indicated that Holt-Winters multiplicative seasonal exponential smoothing method is suitable for residential. Box-Jenkins method using SARIMA is suitable for small general service. Holt-Winters additive seasonal exponential smoothing method is suitable for medium general service, and Decomposition additive method is suitable for large general service.

Keywords: Electricity consumption, Box-Jenkins method, Decomposition method, Holt-Winters exponential smoothing method

Forecasting for the Retail Prices of Gasohol 95 in Bangkok by Box-Jenkins method Artificial Neural Network method and Combined method

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In a study and comparison of the performance of Gasohol 95 price prediction method in Bangkok by the Box-Jenkins method, Artificial Neural Network method and Combined method. Using the data on the retail price of Gasohol 95 in Bangkok from the website of Bangchak Corporation Public Company Limited. The researchers divided the data into two parts. The first part was use to find models for each forecasting method, using data from January 2013 to December 2019, a total of 84 months. The second part was used to compare the performance of the Gasohol 95 price prediction methods and choose the most suitable model using data from January 2020 to December 2022, a period of 36 months. The criteria for comparison was the mean of the absolute error percentage (MAPE) and the square of the mean error (MSE) with the lowest values. The results showed that suitable model for predicting is the Artificial Neural Network method, which has a MAPE of 0.2312 and an MSE of 80.0574.

Keywords: Artificial Neural Network, Box-Jenkins method, Combined method, Gasohol 95

Development of graphene oxide and polymer composite materials for carbon dioxide capture

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Carbon-based adsorbents have garnered significant interest as materials for capturing carbon dioxide due to their high absorption capacity and various unique properties, such as a large surface area, good adsorption stability, and highly porous structure. In this research project, GO/polymer composites were synthesized using various polymers to enhance the surface area by increasing the amount of functional monomers. The study of the morphology of the composite materials GO/polymer using Scanning Electron Microscope (SEM) technique revealed the formation of a porous material suitable for use as an absorbent material. Surface area analysis using BET demonstrated that GO/polymer composites with increased surface area through the addition of functional monomers exhibited higher surface areas and pore numbers. This could indicates the enhanced of CO_2 adsorption in the composite GO/polymer that show a hierarchical structure and capability of CO_2 adsorption.

Improved Kinetics in Spinel-Related 5 V Positive Electrode Material of Lithium Nickel Manganate Derived from Metal−Organic Frameworks for Lithium-Ion Batteries

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The bimetallic organic-inorganic hybrid complex (Ni/Mn-1,3,5-BTC BMOF) (1,3,5-BTC = 1,3,5-benzenetricarboxylic, BMOF = bi-metal organic framework) was synthesized via a solvothermal method coupled with the elevated-temperature solid-state method with lithium carbonate to prepare a spinel-type lithium nickel manganate ($LiNi_{0.5}Mn_{1.5}O_4$). The structure of the $LiNi_{0.5}Mn_{1.5}O_4$ was represented by powder X-ray diffraction (XRD) and Raman spectroscopy. The morphology of the $LiNi_{0.5}Mn_{1.5}O_4$ was analyzed by scanning electron microscopy (SEM). The electrochemical properties of $LiNi_{0.5}Mn_{1.5}O_4$ indicated that employing $NiMn_2O_4$ derived from BMOF as a precursor was the optimal synthetic condition. The discharge specific capacity can reach 23.5 mA h g^{-1} with an open-circuit voltage of ca. 3.0 V and upper cutoff voltage of ca. 4.9 V at 0.1 C. The initial discharge-specific capacity of 1.15 mA h g^{-1} at 1 C had a Coulombic efficiency of 92.74 %. This was 0.25 mA h g^{-1} at a high rate of 2 C increasing to 21.5 mA h g^{-1} after returning to 0.1 C with 91% of the initial discharge specific capacity after 50 cycles. The superior electrochemical performance, particularly during a low-rate operation, was conferred by interconnected multi-faceted particles of $LiNi_{0.5}Mn_{1.5}O_4$ prepared by employing $NiMn_2O_4$ derived from BMOF as a precursor.

Keywords: Bi-metal organic framework, Lithium nickel manganate, Lithium-ion battery, Cathode material, Spinel

L-Ascorbic Acid-Derived Metal-Organic Frameworks Towards Bioengineering Application

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Metal-Organic frameworks or MOFs represent a class of materials widely applied across diverse domains, and recently emerging biomedical applications. Creating biocompatible MOFs takes into account both the intended application and the necessity of the material to be non-toxic and safely applicable in a biological context. Our research aims to optimize the synthesis parameters for incorporating L-ascorbic acid as biologically friendly linkers in MOFs. Zinc and magnesium were chosen as a metal source as they are essential elements in the human body. Solvents, including water, ethanol, dimethylformamide and a mixture thereof were explored. Of all the synthesis conditions, two of them yields crystals suitable for analysis using a single crystal X-ray diffractometer (SC-XRD) were obtained, designated as AS1 and AS2. The product obtained from AS1 was identified as a mix of zinc-ascorbate MOF and a perovskite-type hydrazinium zinc formate framework, whereas the product from AS2 was described as zinc formate dihydrate. Although we did not achieve our initial goal of successful synthesis, these results indicate that DMF is unsuitable for synthesizing ascorbate-MOF due to the hydrolysis of DMF, which produces formate ions competing for coordination with metal ions.

Keywords: Metal-Organic Frameworks, Ascorbic acid, Biocompatible, Zinc-ascorbate

The study of conversion of agricultural waste to graphene-based materials via catalytic carbonization

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Coconut is a crucial economic plant and a leading export product in Thailand. However, its cultivation and processing generate a significant amount of agricultural waste, leading to environmental issues. To manage this waste and prevent environmental harm, this research has focused on converting agricultural waste into high-value products. Coconut coir is one of lignocellulosic biomass containing lignin, cellulose, and hemicellulose, which can be utilized as a renewable carbon source for porous carbon production. In this study, coconut coir was converted into activated carbon. First, the coconut coir was converted into hydrochar through hydrothermal carbonization at different temperatures of 200, 220, 240 °C for constant residence time of 4 h. The physico-chemical properties of C-H200, C-H220, and C-H240 were studied with FTIR, Raman, XRD, SEM/EDS and TGA analyses. The results showed that hydrochar yield was influenced by hydrothermal temperature. It was found that the highest yield of hydrochar was 73% for C-H200, follow by 59% for C-H220, and 53% for C-H240, respectively. The C/O ratio for all hydrochars were found in similar ratio of 2.06, 2.37, and 2.22 for H-200, H-220, H-240, respectively. The results of functional groups of hydrochar changed by different hydrothermal temperature confirmed by FTIR. In addition, the as-synthesized hydrochar was then pyrolyzed at 800 °C under N_2 using $FeCl_3$ and $ZnCl_2$ as catalysts. The study investigated suitable conditions such as the ratio of coconut coir to metal catalyst, and the amount of graphitization promoter needed for porous carbon formation.

Keywords: Coconut coir, biomass, hydrothermal carbonization, pyrolysis, carbon nanomaterials

Investigation and fabrication of paper-based SERS substrates for cannabinoids detection

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Surface-enhanced Raman spectroscopy (SERS) has emerged as an important tool for trace chemical analysis. This research investigates the development of a paper-based SERS device that can be used in conjunction with paper chromatography for chemical separation. In the study, silver nanoparticles were synthesized on glass fiber filter paper with pore sizes of 0.7 µm and 1.2 µm. The devices were tested for SERS detection and separation of two dyes, methylene blue (MB) and rhodamine 6G (R6G), as well as two cannabinoids, i.e., tetrahydrocannabinol (THC) and cannabidiol (CBD). The results showed that SERS chips prepared from papers with pore sizes of 0.7 µm and 1.2 µm had average nanoparticle sizes of 209.48 ± 107.81 nm and 189.16 ± 67.58 nm, and average gap widths of 76.17 ± 30.97 nm and 76.76 ± 26.08 nm, respectively. The optimal times for immersing the papers in Tollens' reagent during fabrication were found to be 5 minutes for 0.7 µm pore size paper and 1 minute for 1.2 µm pore size paper. The SERS chips could detect MB and R6G at concentrations as low as 10^{-6} M and successfully separated the two dyes with distinct Rf values: 0.10 for MB and 0.83 for R6G when using 0.7 µm pore size chips, and 0.13 for MB and 0.93 for R6G when using 1.2 µm pore size chips. However, the SERS chips could not detect THC and CBD, possibly due to their lipophilic nature of these compounds that may prevent them from attaching to the substrates. Nevertheless, this work demonstrates the cost-effectiveness and efficiency of the paper-based devices for detecting trace analytes in aqueous solutions. With the incorporation of paper chromatography, these devices show potential for analyzing complex samples, and can be further developed for diverse applications, such as food safety and environmental monitoring.

Keywords: Surface-enhanced Raman spectroscopy, SERS, Silver nanoparticles, Paper chromatography, MB and R6G

Synthesis of two-dimensional metal organic framework nanosheets for Lubricant Additives

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At present, lubricants are a key factor in many industries. Because lubricating oil helps extend the life and improve the performance of various machines. It also helps prevent wear, corrosion and stains. As the mention of the importance of lubricants above. This research therefore synthesized 2D metal-organic framework (MOF) nanosheets using metal ions of Ni^{2+}, Zn^{2+} and Cu^{2+} with organic ligands that are dicarboxylic acid derivatives. The structure of the synthesized substances can be confirmed using FT-IR, XRD, SEM and TGA. They were used as additive in lubricating oil to improve tribological properties. All studies were found that Ni-NH_2BDC-MOF which 2D-MOF nanosheets shows good performance in high dispersion stability, reducing friction coefficient and wear scar compared to other materials. These performance will support high quality of tribological properties.

Keywords: Metal-organic framework, 2D-MOF nanosheets, Lubricant additives, Tribological properties.

Fabrication of hydrogel composite from cellulose derivatives for selective adsorption of some organic dyes in water

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Organic dyes are widely used in various industries; however, the release of dye-contaminated wastewater can adversely affect both aquatic environment and human health. Therefore, effective removal of these toxic dyes is very crucial. In this study, hydrogel adsorbent materials were designed and prepared from two cellulose derivatives: carboxymethyl cellulose (CMC) and TEMPO-oxidized cellulose nanofiber (TOCNF), via physical crosslinking using citric acid. Montmorillonite (MMT), an inorganic additive, was also added to enhance the strength of the hydrogels. The preliminary results demonstrated that the hydrogel composites were not durable during the adsorption experiment, as evidenced by their slight disintegration. Hence, the hydrogels were further modified by incorporating various amounts of polyvinyl alcohol (PVA) to achieve increased stability. The hydrogels were then characterized using Scanning electron microscopy (SEM) and Fourier-transform infrared spectroscopy (FTIR). Subsequently, the adsorption studies were conducted using methylene blue (MB) and the absorbance of the residual dye was measured using UV-Vis spectrophotometer. The effects of pH, time, MB concentrations, PVA, and MMT were also investigated to determine the optimal absorption performance of the prepared hydrogels. The selectivity study revealed that the hydrogel exhibited preferential adsorption of cationic dye over anionic dye. Additionally, the hydrogel composite showed great reusability with a slight loss in adsorption capacity after 3 cycles.

Keywords: cellulose, hydrogel composite, citric acid, adsorption, methylene blue.

Amino acid fertilizer derived from poultry bio-waste

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Rapid growth in food industry has resulted in increasing bio-waste causing problem to surrounding environment. One of the bio-wastes are chicken feathers from poultry processing industries which are generally disposal in landfills. In this study, chicken feathers were hydrolyzed with 6M H_2SO_4 for 5 hours in order to produce amino acid fertilizer. Hydrolysate were analyzed to study type and quantity of amino acids, comparing with those in chicken feathers, using amino acid analyzer. The result show that cystine, glutamic, serine, proline and leucine are major amino acids with concentration higher than 5% w/w in the chicken feathers. After hydrolysis, significant amount of amino acids are reduced due to strong hydrolysis conditions. The growth enhancement efficiency of amino acid fertilizer was studied using tomato (Solanum lycopersicum var. cerasiforme) as a test plants. The results show that tomato plants with NPK fertilizer and 10% amino acid fertilizer had better growth than others conditions. In addition, it also exhibit highest chlorophyll content. This foliar fertilizer may be used to generate valued added product from bio-waste, promoting zero waste economy.

Virtual screening of anti-Alzheimer disease from Thai remedy "Yahom Thapajit"

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Thailand has entered an aging society. The elderly society often encounters health problems such as Alzheimer's disease (AD) or dementia. AD affects thought process behavior and daily living skills. At present the exact cause of AD is unclear, the available FDA drugs are just for slowing down the symptoms; however, they cannot cure AD completely. Some herbs are known to prevent symptoms of dementia. Therefore, this study aimed to find the active ingredients in the Thai remedy "Yahom Thapajit" that can inhibit the acetylcholinesterase (AChE) using virtual screening including molecular docking and molecular dynamics simulations. Structures of compounds from the herbs in the remedy were first constructed and geometrically optimized. Molecular docking was then performed to find the compounds which can bind to AChE tightly. Eugenol was selected to be the best candidate to be AChE inhibitor. Then, molecular dynamics (MD) simulations were performed to the complex between AChE and eugenol. Analysis of MD results indicated that eugenol which is an active ingredient from the Thai remedy "Yahom Thapajit" can be the candidate for the development of AChE inhibitor.

Synthesis of anticancer *cis*-alkene via catalytic deoxygenation of *trans*-epoxide

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This research project aims to develop a new method for the synthesis of *cis*-cinnarizine and combretastatin A4 which are *cis*-alkenes that showed effective anticancer activity using deoxygenation of *trans*-epoxides that provide *cis*-alkenes as a key step. Naturally occurring and inexpensive cinnamyl alcohol was used as a starting material for synthesizing *cis*-cinnarizine. It was found that 1-benzhydryl-4-((3-phenyloxiran-2-yl)methyl)piperazine which is an epoxide intermediate was obtained in 81% yield. Unfortunately, the desired *cis*-cinnarizine was not obtained and the epoxide substrate was recovered. For the synthesis of combretastatin A4, we did a screening of the reaction conditions for deoxygenation of *trans*-epoxide to *cis*-alkene using the *trans*-stilbene oxide as a precursor provided *cis*-stilbene in 45% yield.

Keywords: deoxygenation, epoxides, *cis*-cinnarizine, combretastatin A4

Development of the Bioactive Molecular Database from "Hanuman Pidtanon Jongmahasamutr", and "Kae Bid Long Pen Lueat" Remedies and Virtual Screening for COX-2 inhibitors

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Inflammatory diseases can be caused by either bacteria or the body's mechanism for maintaining balance when an injury occurs. In this research, cyclooxygenase-2 enzyme (COX-2 enzyme) was used as a target for searching for bioactive compounds from Thai remedies including "Hanuman Pidtanon Jongmahasamutr", and "Kae Bid Long Pen Lueat" Remedies. Therefore, a search was made for the active ingredients in both recipes, resulting in the molecular structures of 513 compounds. Virtual screening was used based on the GOLD method. All compounds were docked into the COX-2 binding site. The top ten compounds were selected and followed by ADMET prediction. After analysis of the best binding, it was found that Demethoxycurcumin shows good COX-2 inhibition. Consequently, the complex between COX-2 and Demethoxycucumin was simulated by Molecular Dynamics simulations. Structural and energetic were analyzed based on RMSD, Rg, RMSF, Number of Hydrogen bonds, and Cluster analysis at a simulation time of 0 - 1 0 0 ns. The obtained results indicated that Demethoxycurcumin can inhibit COX-2 enzyme with key amino acids interaction in the binding site.

Heterologous expression of natural product genes from *Menisporopsis theobromae* BCC 4162 and *Dictyostelium discoideum* in *Nicotiana benthamiana*

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In this work, natural product genes, aristolochene synthase gene (*mtas*) from the fungus *Menisporopsis theobromae* BCC 4162, involved in aristolochene biosynthesis, and 6 polyketide synthase genes (*pks*) from the slime mold *Dictyostelium discoideum* were studied for metabolite production in *Nicotiana benthamiana*. Aristolochene synthase is responsible for the cyclization of acyclic farnesyl pyrophosphate (FPP) to aristolochene. This compound is a precursor for the synthesis of several bioactive compounds. On the other hand, polyketides are biosynthesized by polyketide synthases found in plants, fungi, and bacteria. Polyketides exhibit diverse biological activities such as antimicrobial and anticancer activities. All MtAS and PKS genes were introduced into *Nicotiana benthamiana* for expression and metabolite production. Subsequently, the leaves of *N. benthamiana* were extracted using hexane and methanol, respectively. The crude extracts were then analyzed by Gas Chromatography-Mass spectrometry (GC-MS) and High Performance Liquid Chromatography (HPLC). The results showed that the crude extracts of *N. benthamiana* leaves carrying *pks25* exhibited differences in HPLC profile compared with the control. Based on this result, more *N. benthamiana* leaves will be used for transferring *pks25* in order to obtain enough compounds for purification, structure determination and screening for their biological activities.

Keywords: Aristolochene synthase, *Menisporopsis theobromae* BCC 4 1 6 2 , *Nicotiana benthamiana*, *Dictyostelium discoideum*, polyketide synthase.

The computational studies of Rilpivirine – resistant HIV Reverse Transcriptase for drug design and development

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HIV infection remains a major global health concern, affecting millions worldwide. While antiretroviral therapy (ART) has significantly reduced disease morbidity and mortality, the emergence of HIV drug resistance can lead to treatment failure. Reverse transcriptase (RT) is a key target implicated in drug resistance development. Non-nucleoside reverse transcriptase inhibitors (NNRTIs), commonly used in treating HIV-infected patients, have led to the rapid emergence of drug resistance due to their widespread use. NNRTIs exert antiviral activity by directly binding to RT and inhibiting its enzymatic function. Rilpivirine (RPV), a second-generation potent NNRTI, is widely prescribed for HIV treatment, even in drug-resistant cases. However, RPV can fail in certain drug-resistant situations where the molecular details of resistance mechanisms remain unclear. This study employed molecular dynamics (MD) simulations to investigate RPV binding to RT, comparing prevalent mutated RT forms with the wild-type enzyme. The simulations revealed that the K101P mutation in RT leads to the loss of hydrogen bonds between RPV and the enzyme, resulting in a weaker binding affinity of RPV to the mutated RT. The insights gained can guide the future development of novel NNRTIs designed to combat drug-resistant HIV strains. By understanding the molecular mechanisms underlying drug resistance, researchers can develop more effective and durable antiretroviral therapies, improving treatment outcomes for HIV-infected individuals worldwide. This study highlights the importance of molecular-level investigations in elucidating the intricate interactions between antiretroviral drugs and their targets, paving the way for rational drug design strategies tailored to overcome specific resistance mutations. Continuous monitoring of HIV drug resistance patterns and developing novel therapeutic approaches to suppress viral replication despite emerging resistance are essential steps in the global fight against HIV.

Keywords: HIV; Reverse transcriptase; NNRTIs; molecular dynamics

The binding mechanism of Atazanavir to drug-resistant HIV-1 protease: A simulation study

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The problem of HIV drug resistance is caused by mutations in drug targets. One of the major drug targets is HIV-1 protease. This protein plays a crucial role in the life cycle of HIV. Atazanavir (ATV) is a commonly used drug for protease inhibition. However, the long-term use of ATV results in drug resistance. To date, there is no data on how ATV causes drug resistance. Thus, in this work, Molecular Dynamics (MD) simulations were conducted for 500 ns with a repeat to investigate the binding mechanism of ATV to mutated protease (I50L, I84V, N88S) in a drug resistance condition in comparison to wild-type protease. The closed/open structure of HIV-1 protease and the compactness of the pocket site were studied. It was found that mutations at these positions significantly affect the stability of the HIV-1 protease structure in terms of RMSD, RMSF, SASA, PCA, Hydrogen formation potential, interaction energy. Particularly, the position I50L studied had a notable impact on the conformational changes, causing the pocket site region to become more flexible. In summary, mutations in the I50L, I84V, and N88S positions cause changes. Binding of HIV-1 protease to ATV and leading to distortion of drug efficacy. The obtained data can potentially be used to design and develop new potential drugs that are more effective and can inhibit drug-resistant HIV-1 proteases.

Keywords: HIV-1 protease, Atazanavir (ATV), MD simulation.

Virtual screening of Thai herbal medicine "Yahom Inthajak" for Alzheimer's disease by computational calculations

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At present, statistics show that one of the leading diseases and causes of death globally is Alzheimer's disease, which is a type of dementia that commonly occurs in the elderly but can also manifest during working age due to factors such as heavy workloads and insufficient rest. Accumulated evidence suggests that Acetylcholinesterase is an enzyme capable of decomposing Acetylcholine, a crucial neurotransmitter involved in various bodily functions. The relevant protein is Human Acetylcholinesterase Protein. Several Thai herbs have been reported to have the ability to inhibit and prevent Alzheimer's disease. Hence, a study was conducted to search for active compounds inhibiting the activity of this protein from the Thai medicinal formula "Yahom Inthajak". This was done using computational calculation methods, including various techniques such as Molecular Docking to examine the positioning of compounds that inhibit the activity of Human Acetylcholinesterase Protein, and Molecular Dynamics (MD) simulations to study molecular interactions and analyze various reactions. The results are RMSD, RMSF, Rg, Number of Hydrogen bonds, and Cluster analysis during simulation time 0-100 ns. The study concluded that Tonkinensisin A in the *Styrax tonkinensis* (Pierre) Craib ex Hartwich herbal plant of Yahom Inthajak have inhibitory effects on the activity of Human Acetylcholinesterase Protein.

Virtual Screening of Survivin inhibitors from "Navagote" remedy as anti-cancer

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Cancer is a group of diseases caused by abnormalities in cells of various organs in the body, resulting from genetic mutations. In 2020, the World Health Organization (WHO) reported nearly 10 million deaths from cancer, with an additional 18.1 million new cancer cases. The Human Survivin Protein, which is associated with inhibiting cell death and controlling cell cycle, is often found in various human cancers. Therefore, the Human Survivin Protein is crucial for cancer treatment. This research focuses on studying and identifying compounds from traditional medicinal herbs with the ability to inhibit cancer targeting the Human Survivin Protein. The study involves employing computational chemistry methods to simulate the interaction between ligands and target proteins, starting with structural optimization and then analyzing the binding through molecular docking techniques. The top 10 structures with the highest gold score are selected for further analysis of drug-like properties using SwissADME, and the best structure identified is dioleolinolein. This compound is then analyzed with the target protein using Molecular Dynamics (MD) simulations, assessing parameters such as RMSD, Rg, RMSF, number of hydrogen bonds, and cluster analysis. The results indicated that dioleolinolein effectively binds to the Human Survivin Protein.

Study on the synthesis of core-shell polymer for electro-swing CO₂ capture

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CO_2 separation from gas mixtures demands large quantities of energy. However, a promising alternative employing electrochemistry has emerged. At the heart of this system lies a redox molecule, such as Quinone, capable of selectively capture and release CO_2 at designated potentials. Nevertheless, this molecule remains susceptible to oxidative reactions with oxidizing agents, notably oxygen present in the ambient air, thereby diminishing the longevity of the system. This study focusses on straightforward procedures for synthesizing materials possessing high surface areas capable of integrating redox molecules into their structures. The initial approach involved the fabrication of core-shell polymeric particles, known for their stability and adaptability, wherein redox molecules were introduced onto the shell layers via simple chemical reactions. However, electrochemical techniques revealed an absence of noticeable electrochemical signals from the Quinone within this material, indicating potential synthesis-related challenges. Alternatively, another method utilized the mechanochemical incorporation of Quinone into Metal-organic frameworks (MOFs), exemplified by the utilization of generic MOFs such as UiO-66 to illustrate this feasibility. Upon testing, electrochemical signals were detected utilizing this approach, signifying successful embedding of the redox molecule within the materials. This methodology presents a promising avenue for further exploration for the electrochemical CO_2 separation from the mixed gas in the foreseeable future.

Synthesis of methacrylic acid-modified calcium phosphate nanoparticles as reinforcing fillers for dental adhesives

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Dental adhesives (DAs) play a crucial role in modern restorative dentistry by facilitating the reliable and long-lasting bonding of dental materials to tooth surfaces. The addition of nanofillers has emerged as a significant advancement in dental adhesive technology, including improved mechanical properties and enhanced tissue adhesion. The use of calcium phosphate nanoparticles (CaPNPs) as reinforcing nanofillers in dental adhesives is particularly promising due to its bioactivity and compatibility with tooth structure. Herein, calcium phosphate nanoparticles (CaPNPs) were synthesized via the water-in-oil emulsion method using Tween80 as a surfactant, followed by surface modification with methacrylic acid (MAA). This modification facilitates the incorporation of CaPNPs into the adhesive matrix and improves the interaction between the nanoparticles and the surrounding resin, ultimately enhancing the bonding performance of the adhesive. The adhesives containing the methacrylic acid-modified calcium phosphate nanofillers were developed and characterized using TEM, SEM, FTIR, and micro-tensile bond strength (µTBS) analysis to confirm high photopolymerization, resin tag formation, along with higher bond strength compared to adhesives without ones. The use of CaPNPs modified with MAA represents an innovative approach to enhance the efficiency and efficacy of dental adhesives.

Keywords: Dental adhesives, Calcium phosphate, Nanoparticles, Methacrylic acid, Biomaterial

Upcycling of spent primary battery for the production of manganese oxide as a cathode for rechargeable zinc-ion battery

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Black powder obtained from disassembling the cathode components of spent zinc-carbon primary batteries was chemically treated with 2 M H_2SO_4 and 30% v/v H_2O_2 to leach out all valuable metals. The leaching solution was then analyzed for the determination of zinc and manganese using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) and the results reveal that the average amounts of zinc and manganese in the black powder were about $26.81 \pm 0.87\%$ w/w and $31.05 \pm 0.60\%$ w/w, respectively. The resulting solution was utilized to synthesize MnO_2 via hydrothermal method. Various experimental conditions were employed to obtain different crystal forms of MnO_2.

(i) α-MnO_2 was synthesized by treating leachate solution with K_2SO_4 and $K_2S_2O_8$.

(ii) γ-MnO_2 was synthesized by treating leachate solution with $NaBrO_3$.

(iii) β-MnO_2 was synthesized by treating as-obtained γ-MnO_2 with HCl.

(iv) λ-MnO_2 was synthesized by treating as-obtained $LiMn_2O_4$ with HCl.

All as-synthesized MnO_2 products were analyzed for their structures using X-ray Diffraction (XRD) and the results confirm the formation of α-MnO_2, β-MnO_2, γ-MnO_2, and λ-MnO_2, respectively. Scanning Electron Microscopy (SEM) images reveal that α-MnO_2 exhibits a fibrous urchin-like structure, mixed β/γ-MnO_2 displays both a fibrous structure of γ-MnO_2 and the large rod-like structure of β-MnO_2, γ-MnO_2 appears as strands curled together, like a bouquet of flowers, and λ-MnO_2 exhibits a cubic like structure. Additionally, all products underwent electrochemical testing for their specific capacity. It was found that α-MnO_2 exhibits the initial specific capacity of 120.14 mAh/g, β/γ-MnO_2 24.39 mAh/g, and γ-MnO_2 280.79 mAh/g.

Advancing the material upcycling from spent primary battery toward innovation in supercapacitor applications

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Black powder obtained from separating the components of spent zinc-alkaline batteries was chemically treated with 2 M H_2SO_4 and 30% H_2O_2 to extract metal ions. The leaching solution mainly contained soluble manganese and zinc species as determined from Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) and the results show that 26.59% Zn^{2+} and 37.07% Mn^{2+} were quantitatively found in the solution. Then, the controlled precipitation of ZnS using Na_2S as a sulfide source was systematically studied with the variation in pH (1.6-2.9). The results from Energy Dispersive X-ray Spectrometry (EDX) suggest that the amounts of coprecipitating Mn^{2+} in ZnS (Mn^{2+}:ZnS) were found to be 0.60, 0.96, 1.01, and 1.47% with increasing the solution pH. It is clearly seen that all as-obtained Mn^{2+}:ZnS adopted the zincblend structure as confirmed by X-ray Diffraction (XRD). For the electrochemical measurements, the cyclic voltammograms (CV) for all Mn^{2+}:ZnS show a clear pair of redox peaks which corresponds to the conversion between the different valence states of Zn species. With an increase in scan rate, the anodic and cathodic peaks shifted toward a positive and negative direction, respectively, and the peak currents increase, suggesting a rapid redox reaction. Galvanostatic charge-discharge (GCD) analysis indicates the specific capacitance of Mn^{2+}:ZnS obtained at pH 2.93 was about 606.25 F/g at current density of 1 A/g which is superior to other Mn^{2+}:ZnS at different pH.

Keywords: Upcycling, Spent primary battery, Mn^{2+}:ZnS, Supercapacitor

Electrochemical sensor detection of enrofloxacin by AuNPs and carbon powder modified screen-printed carbon electrode

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Enrofloxacin is a second-generation fluoroquinolone antibiotic commonly used to treat bacterial infections in livestock. It has bactericidal activity and is effective against both resting and growing bacteria. Therefore, enrofloxacin is found as a pollutant contaminating natural sources and animal-derived products. If humans accumulate excessive levels of enrofloxacin, it may lead to health problems, such as affecting the digestive system, damaging cartilage in joints, affecting the optic nerve, and affecting the nervous system. For these reasons, it is necessary to measure enrofloxacin levels. In this research, enrofloxacin was detected by using a AuNPs/PDDA/CB modified carbon screen-printed working electrode with cyclic voltammetry (CV), differential pulse voltammetry (DPV), and impedance spectroscopy (EIS) techniques. The modified electrode showed excellent electrochemical performance and high sensitivity, in a linear range of 2 – 20 µM and 20 - 100 µM. The limit of detection (LOD) was 0.0393 µM and the relative standard deviation (%RSD) was 2.5%.

Keywords: Enrofloxacin , screen-printed carbon electrode

Nano/Microstructured silicon-carbon composite as an electrode materials for hybrid supercapacitors

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Recently, high electrochemical performance anode materials for lithium-ion secondary batteries are of interest. Here, we present silicon-carbon nanotube-graphene oxide (SiCNTrGO) composites for high performance anode materials of lithium-ion secondary battery (LIB). rGO is used to form a multilayer structure which is supported by CNT and the silicon nanopartarticles (SiNPs) are dispersed in the CNT gap. Within this composite, CNTs and SiO_2 are dispersed on the flexible rGO, serving as the supporting framework and conductive bridge of rGO. The SiCNTrGO nanocomposite showed a specific capacitance of 102 Fg^{-1} at 0.1 A/g, energy density of 3.3 $Whkg^{-1}$ at power density of 48 Wkg^{-1}. These characteristics have assured the superior electrochemical performance of the silicon-carbon nanotube-graphene oxide (SiCNTrGO) electrode.

Deposition of Indium Tin Oxide Film on a Glass Substrate by RF-sputtering Technique

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Thin films of indium tin oxide (ITO) were deposited on a glass substrate by radio-frequency magnetron sputtering at a power of 150 W at sputtering times of 5,10,15,20, and 25 minutes. The structural properties, optical properties, electrical conductivity, and surface thickness of indium tin oxide thin films were studied. From SEM results, films with thicknesses of 43, 68, 84, 115, and 210 nm were obtained. Structure determination from XRD found structure phases of ITO (222) from a thickness of 84 nm and the ITO (440) phase was found at a thickness of 210 nm. Thin films of indium tin oxide that were coated at 25 min had low resistance and good electrical conductivity, but for a film with a sputtering time of 5 min, no resistance could be determined.

Keywords: ITO thin films**,** Thickness, Phase structure, Optical properties, Electrical properties.

Synthesis WO$_3$/rGO nanocomposite for NH$_3$ gas sensor

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In this project, WO$_3$/x% rGO nanocomposites (x=5%, 10%, 15%, and 20%) were synthesized using the solvothermal method. The structure of WO$_3$/x% rGO nanocomposites was studied by X-ray diffractometer (XRD). The result showed that structure of WO$_3$/x% rGO nanocomposites was a hexagonal. The results from Scherrer's equation determined that the crystallite sizes of all nanocomposites were similar. In addition, UV-Visible spectrometer used to study the optical property and the Energy Band Gap (Eg). The results showed that the E$_g$ decreased with the increasing of rGO sheet. Scanning Electron Spectrometer (SEM) was used to study the surface morphology of WO$_3$/x% rGO. The result found that Tungsten oxide (WO$_3$) nanoparticles were distributed on the surface of rGO sheets. For NH$_3$ sensor, the WO$_3$/x% rGO nanocomposites can detect the NH$_3$ gas and it is suitable for making NH$_3$ sensor.

Keywords: Tungsten oxide, rGO

Flexible Sensor Based on Zinc Strontium Sulfide for Methanol Detection

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Quantum dots (QDs) offer significant advantages in gas sensing applications including high sensitivity, tunable properties, fast response times, and the potential for miniaturization and integration. These benefits make quantum dot-based gas sensors promising tools for a wide range of industries from environmental monitoring to industrial safety and healthcare. Zinc strontium sulfide (ZnSrS) is a notable material due to their beneficial properties such as catalytic behaviour, fast mobility of ions, and higher electronic conductivity that are useful for bioimaging, display technologies (LCD), and light emitting diodes (LEDs) applications. However, the study of ZnSrS in form of quantum dots for gas sensing application is still less. In this work, we present the synthesis of ZnSrS QDs by using a one-pot-heat-up method and used as a sensing material to detect the target gas. The synthesis of ZnSrS QDs involves a chemical reaction between three precursors including zinc (zinc chloride), strontium (strontium chloride) and sulfur (thioacetamide). The three precursor solutions were combined in three-necked flask, which filled with Oleylamine, 1-Octadecans and Oleic acid under inert gas (Nitrogen) at specific temperatures to form the QDs. In order to investigate the response and selectivity of the ZnSrS flexible gas sensor, they were exposed to a variety of gases/VOCs including methanol, ethanol, propanol, formaldehyde, toluene, acetone and ammonia at room temperature. The results show that the ZnSrS QDs flexible gas sensor can effectively detect methanol at room temperature.

Wearable and Flexible multi-color electroluminescent device for Gas Detection

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Currently, the alternating current electroluminescent (AC-EL) is integrated into various aspects of human daily life such as digital watches, car dials, etc. In this work, we propose a new design of AC-EL device incorporating a MXene QDs/AgNPs humidity-sensing layer instead of an insulating buffer layer for humidity detection. The ZnS:Cu, Cl and ZnS:Ag$^+$(Zn,Cd)S:Ag phosphors were used as an emissive layer prepared by screen printing method. MXene quntum dots $Ti_3C_2T_x$ QDs were synthesized via an oil bath system while silver nanoparticles (AgNPs) were synthesized by using a green method. Mxene QDs/AgNPs were employed as a humidity sensing layer due to high response and good productivity. The new design of AC-EL devices exhibits multi-color, wearable, and flexible characteristics representing a novel type of plastic illumination device that can utilize base materials from PET plastic to replace expensive ITO substrates. The humidity sensing results demonstrate an exponential relationship with humidity in the range of 20%–90% RH with no significant effects observed with various VOCs/gases such as methanol, ethanol, toluene, acetone, propanol, formalin, and ammonia at room temperature. Furthermore, the luminescent intensity of the sensors depends on the excitation frequency, applied voltage, and wave function.

Effects of Fe Single-Atom Catalyst on Functionalized Dicalcium Nitride Monolayer for LithiumSulfur Batteries: A First-Principles Study

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Currently, the use of lithium batteries plays an important role in everyone's daily life and drives the development of numerous modern technologies. Lithium sulfur batteries (LSBs) are seen as a next-generation energy storage that could replace lithium-ion batteries, which are ubiquitous over the past decades. This is due to the much higher energy density and the fact that sulfur is inexpensive and more abundant in nature. However, a poor cycling performance caused by the polysulfide shuttle is one of the well-known issues needed to be solved. The goal of this project is to study the way to inhibit such process with a 2D dicalcium nitride monolayer (Ca_2N) as an anchoring material for cathode by using first-principles calculations based on density functional theory. First, we have checked the formation of N, F, Cl, and OH functional groups on the surface of Ca_2N and its adhesion to a sulfur molecule (S_8). Ca_2NCl_2 is revealed to have a good absorption with S_8 and it has thus been used to investigate the adsorption of lithium polysulfide molecules (LiPSs) which occurs along sulfur reduction in discharging process. A comparison between the absorption energy and binding energy suggests that long-chain LiPSs slightly prefer to adsorb on the surface rather than binding with DME electrolyte molecules. To improve the LiPSs adhesion, a single Fe atom catalyst has been added to the surface. While Li binds with the surface Cl atoms, Fe helps creating a strong attraction to S atoms due to its better electron donating ability. However, Bader charge analysis revealed the reduced charge transfer from S_8/LiPSs to $Fe@Ca_2NCl_2$ because of the Fe-S bonding. These results point out the capability of this anchoring material to suppress the shuttle effect.

Quaternion formulation of rotational kinematic equation

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In this project, we use the quaternions to analyze the rotation of an object attached to an IMU sensor MPU-6050. The angular speed around the X, Y and Z axes fixed to the sensor are obtained from the rate gyro data. There data are used to obtain the rate of change of the corresponding quaternions. The kinematic equation are there constructed to calculate the orientation of the object in terms of the Euler angles with respect to the earth. We embed a python code to the MPU-6050 to collect its rate gyro data while rotating the sensor to various orientations. The results are plotted against the values measured by an inclinometer. We find linear rotation for all X, Y and Z axes, with the slope very close to 1. There results confirm the validity of the quaternion kinematic equation to the sensor orientation measurement.

Keywords: IMU sensor MPU-6050, Quaternion, Rotational kinematic equation.

Learning Electrodynamics and General Relativity in Differential forms

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The goal of the research is to apply what we have learned about differential forms to the study of electrodynamics and general relativity in the connection one-form and curvature two-form sections. Specifically, we will demonstrate how to calculate the full sets of Maxwell's equation in terms of the differential forms by using the wedge product ($\wedge$), exterior derivative (d), and Hodge star operator ($\star$) to study electrodynamics. In the section on connection one-form ($d\hat{\theta}^a + \omega^a_b \wedge \hat{\theta}^b = 0$) in general relativity, we demonstrate how to connect the Lorentz manifold with the Riemann manifold. With the two-form curvature ($R^a_b = \frac{1}{2} R^a_{bcd}\ \hat{\theta}^c \wedge \hat{\theta}^b$), we demonstrate the calculation using the wedge product and obtain the same result as with a standard calculation.

Keywords: Electrodynamics, General relativity, Differential forms

Study of The Effect of Sputtering Power on Properties of Indium Tin Oxide Thin Film on a Glass Substrate

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In this project, indium tin oxide thin (ITO) films were prepared on a glass substrate using RF sputtering with various powers of 100, 125, 150, 175 and 200 W for 30 minutes. The SEM images indicated that film thicknesses were 91, 168, 208, 295, and 343 nm, respectively. All films showed ITO (221), (222), (400), (431), (440) and (622) phases depending on the thickness. The highest intensity of the ITO (222) plan was observed at 175 W. The film deposited at 200 W displayed the highest grain size and roughness but exhibited the lowest energy bandgap. The highest transmittance and the lowest resistance were observed on the film deposited at 125 W. The heating measurement confirmed that the highest temperature was observed on the film at a power of 175. The electrical and optical properties are strongly dependent on sputtering power.

Keywords: Indium tin oxide film, RF-Sputtering, Phase structure, Optical transmittance

Spectrogram Analysis of Durian Punch Sound

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Durian "The King of fruit is a famous fruit in Southeast Asia. Thailand is a leader in producing high quality durian. We may use a punch sound as a preliminary criteria for determining the ripeness of durian. Knocking is done with a rubber-tipped stick into the center of the shell. The sounds are slightly different, in which an experienced farmer can distinguish. In this work, the Matlab program is used to separate sounds and analyze spectrograms and compare the graphs from the first day of cutting until the day the durians are ripe. The results suggest that from day one the frequency components ranged in value from low to high. But in the following days the high frequency elements gradually disappeared. Until the last day of ripening, only the low frequency components remains.

Keywords: Durian, Punch Sound, Spectrograms, Frequency, Fourier Analysis

Stretchable Carbon Nanotubes-Based Sensor for Toluene Detection

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Stretchable sensors have gained significant attention in recent years due to their unique properties and wide-ranging applications. These sensors are designed to deform and stretch with their surrounding materials while maintaining their sensing capabilities making them ideal for applications in fields such as healthcare, robotics to consumer electronics. In this work, a stretchable sensor has been developed for a volatile organic compound (VOC) sensor to monitor the toluene leakage based on carbon nanotubes (CNTs) sensing material. The CNTs offer a combination of mechanical, electrical, and chemical properties that make them highly advantageous for stretchable sensors. The CNTs were synthesized via thermal chemical vapor deposition (CVD) in the lab-made horizontal tube furnace. The iron catalyst powder was loaded for CNTs growth. The process was heated up to 700 °C in a mixture of H2 at 150 sccm and C_2H_2 at 150 sccm with a pressure of 100 Torr. The synthesized CNTs were employed as a sensing element for detecting toluene, a common organic solvent found in various industrial processes and household products. The stretchable CNTs-based VOC sensor demonstrates a strong sensitivity and rapid response to toluene at room temperature. When the sensor is exposed to toluene, the electrical properties change within a few seconds. Moreover, the sensor exhibits excellent repeatability, high stability as well as linear response to toluene concentrations. The sensing mechanism of CNTs-based VOC sensor can be explained via physisorption between electron-donating toluene molecules and p-type CNTs.

Effects of color change in corundum by beryllium heat- treated

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In this project, a study was conducted on the effects of color changes in corundum gemstones (chemically composed of Al_2O_3) using the heat treatment method with chrysoberyl (chemically composed of $BeAl_2O_4$) in an electric furnace at a temperature of 1400 °C for 10 h, followed by reheating in an electric furnace at a reducing atmosphere with the same temperature and duration. At each step, spectrophotometric analysis of the gemstone's absorption spectrum was conducted using a UV-VIS-NIR spectrophotometer to observe any changes in color absorption. It was found that there were no significant differences in the gemstone's spectrum at each step. Additionally, Fourier transform infrared spectroscopy (FTIR) was used to separate heated gemstones from unheated gemstones. It was found that after heating, the peak at 3309 cm^{-1} disappeared due to the high temperature reducing the amount of O-H stretching in the gemstone. Laser-induced breakdown spectroscopy (LIBS) was utilized to analyze the presence of beryllium on the gemstone's surface after heat treatment with chrysoberyl, revealing the presence of beryllium. However, after reheating in an electric furnace at a reducing atmosphere, no presence of beryllium was detected on the gemstone's surface.

Evolution of nematic liquid crystal droplet coalescence on freely suspended liquid crystal smectic film

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Evolution of nematic liquid crystal droplet coalescence on freely suspended liquid crystal smectic film research is to study of fluid dynamics and structural evolution of droplet during complicated coalescence phenomenon. In our investigation, the goal is to investigate nematic liquid crystal droplets coalescence of the mixture of liquid crystal and surfactant floating on the freely suspended smectic liquid crystal film. According to the fragility of the liquid crystal system, in this research, we tried to create and modify the unique oven that has capacity to reduce vibration, maintain the temperature, and block the surrounding air circulation. Implementing the high-speed imaging technique, we are able to observe and record the detailed experimental findings of the coalescence process. The findings were compared with the scaling laws theory of droplet coalescence and the impact of surfactant concentrations was analyzed with the coalescence dynamics.

Keywords: Liquid crystal, freely suspended film, liquid crystal droplet, Nematic, Smectic

Effect of color change on different heat-treated enviroments in corundum

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Corundum, when heat-treated at high temperatures, changes the color of the gemstone. The color changes depend on the environment used within the furnace. The mechanism of color change in heat-treated corundum remains unexplained. Research has only been reported on blue sapphire heat-treated in an oxidizing atmosphere, but few studies have been conducted on the mechanism of color change in corundum in a reducing atmosphere. To address these knowledge gaps, this research project aims to heat-treat corundum gemstones in both oxidizing and reducing environments using samples from Songea at a temperature of 1200 °C, with a soaking time of 10 h. The gemstones will then be analyzed using a UV-Vis spectrophotometer, a polychromatic spectrophotometer, and an FT-IR spectrometer to compare differences in gemstones after heating under different environmental conditions and to elucidate the mechanism of color change in these gemstones. Analysis using a polychromatic spectrophotometer revealed that corundum heat-treated in an oxidizing environment displayed a clearer color, while in the reducing atmosphere, the gemstone will have a darker color, as observed in only one sample, PG2. This may be due to the temperature not being high enough and insufficient gas used in the furnace. The FT-IR results show a peak at 3309 cm^{-1}, which is an O-H bond peak indicating the presence of water within the gemstone, disappearing upon heating at high temperatures. UV-Vis spectra can be used to examine the light absorption of gemstones to explain the color change mechanism.

First-principles investigation of desodiation mechanism and voltage profile in Ni-doped Na$_2$ZrO$_3$ cathode material for Na-ion batteries

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Lithium-ion batteries (LiBs) have a great impact undoubtedly on human's daily life and technological progress in modern society. Due to a rising market demand, lithium's cost has dramatically increased over the past decade, against its limited supplies. As sodium is much cheaper and more abundant than lithium, sodium-ion batteries (SiBs) are thus regarded as a promising and sustainable alternative energy storage for the future, but their performance must be improved to achieve similar performance to LiBs. In this work, we performed density functional theory (DFT) calculations to study Na ion exchange process and electrochemical properties of sodium zirconium oxide Na$_2$ZrO$_3$ (NZO) cathode material. Our results show that Na vacancy occurs in Na-Zr mixed layers and tends to undergo phase changes during charging process. Moreover, Ni substitution effect has been examined for a possible enhancement on the cathode performance. Such doping results in an enhanced electrical conductivity owing to an emerging Ni defect state, and a reduced tendency of phase transformation because of attractive coulombic interactions between nickel and its neighboring Na ions. Using a convex hull, a plot of formation energy of desodiated configurations reveals a metastable state of Ni-doped NZO when the Na content per formula (x) is 0.5 and 1. To prevent from an irreversible capacity, our results suggest that the x value of NZO should not be lower than 0.5. We also found that the open-circuit voltage is increased from 3.03 V to 3.31 V, which is mostly associated with the oxidation of oxygen rather than the Ni dopant.

Keywords: density functional theory, substitution,desodiation

Effect of Sc doping on CO_2 reduction reaction of chalcogenated-Ti_3C_2 monolayer based on density functional theory

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As a climate crisis, global warming is drastically becoming severe and affects all creatures widely. Carbon capture and utilization technology is a crucial key to reduce carbon dioxide amount in the atmosphere, which is a main catalyst promoting this phenomenon, and then create economic value by utilizing that stored carbon. All sectors of the world economy are thus interested in research and development to build a carbon neutrality society. According to this concept, this work has studied a CO_2 capture mechanism and its conversion into methane through a CO_2 reduction reaction (CO_2RR) on a 2D titanium carbide monolayer with chalcogenide surface functional groups ($Ti_3C_2S_2$ Mxene monolayer), which is a fluorine-free catalyst, using quantum simulations based on density functional theory. The calculated results show that Ti_3C_2 surface prefers to be covered by O, S and OH mixed functional groups due to its lower formation energy. The variety of functional groups is more likely present in experiment and help enhancing the surface reaction activity. Considering site-dependency, CO_2 molecule and O-containing intermediates prefer to bind with S functional group while the others prefer O functional group. Gibbs free energy calculations at 300 K reveals that the conversion reaction from CO_2 into COOH is a rate-limiting step with the potential of 1.22 eV. When Ti is substituted with Sc metal, the adhesion between the catalyst and intermediates is improved and the limiting potential is reduced to 0.98 eV. This work reveals the CO_2RR mechanism of S-terminated Ti_3C_2 catalyst and an enhanced efficiency of the CO_2 conversion into CH_4 gas by Sc substitution.

Bioceramics-based Calcium Magnesium Silicate for bone tissue engineering

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Silicate-based bioceramics have attracted biomedical researchers' interest due to their bioactivity and biodegradability. In this study, we synthesized and investigated the physical and bioactivity properties of three different bioceramics of calcium magnesium silicate in the CaO-SiO_2-MgO systems (diopside ($CaMgSi_2O_6$, CMS), akermanite ($Ca_2MgSi_2O_7$, C_2MS) and merwinite ($Ca_3MgSi_2O_8$, C_3MS)). It was found that the compressive strength increased from 14.32 MPa to 24.93 MPa for increasing calcium contents (C to C_3). In addition, the apatite formation ability improved in simulated body fluid (SBF) and culture medium. The degradation of the cements in SBF solution increased with the increase of C content. It can be suggested that the calcium magnesium silicate-based bioceramics with good bioactivity, degradability and bioactivity has great potential to serve as implanted cements for bone defect filler and repairs.

Magnetocaloric Effect in CoFe-Coated Ni$_{50}$Mn$_{33}$In$_{16}$Cr$_1$ alloy

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The Ni$_{50}$Mn$_{33}$In$_{16}$Cr$_1$ alloy was coated with CoFe using a screen-printing method, utilizing a binder composed of polyvinylidene fluoride (PVDF) and dimethylformamide (DMF) at binder intensities of 5% and 10%, and coating thicknesses of 5 mm and 10 mm, respectively. This process aimed to investigate the magnetic properties of the samples, which were subsequently analyzed using X-ray diffraction (XRD), scanning electron microscopy (SEM), and vibrational sample magnetometer (VSM). The change in magnetic entropy was calculated from isothermal magnetization measurements in a magnetic field regime of 10 kOe. The maximum magnetic entropy change (ΔS_M) observed for Ni50Mn33In16Cr1 was 0.70 J/kg·K. Contrastingly, for samples coated with 1 g of CoFe at a 5% concentration, featuring a thickness of 0.5 mm, and 0.5 g at a 10% concentration with a thickness of 1 mm, the maximum magnetic entropy change (ΔS_M) escalated to 1.23 J/kg·K. Furthermore, the alteration in maximum temperature within the alloy due to magnetic field adjustments yielded a reading of 0.31 ºC for Ni$_{50}$Mn$_{33}$In$_{16}$Cr$_1$. Conversely, samples coated with CoFe, comprising 1 g at a 5% concentration, 0.5 mm thick, and 0.5 g at a 10% concentration, 1 mm thick, demonstrated higher temperature changes of 0.54 ºC and 0.46 ºC, respectively, indicating the significant influence of the CoFe layer on the magnetocaloric effect (MCE).

Keywords: Magnetocaloric , Alloy Heusler , Entropy change , CoFe coating

First-principles study of CO, CO$_2$, NO, and NO$_2$ molecules adsorption on metal-doped monolayer BNC$_2$

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In this research, we investigate the gas-sensing properties of the monolayer (ML) BNC$_2$ using density functional theory. We have studied the adsorption of selected gas molecules such as CO, CO$_2$, NO, and NO$_2$ on pristine BNC$_2$ and Li, Mg, and Al-doped-BNC$_2$ MLs. We find that all doped metal atoms protrude out from the BNC$_2$ ML. The introduction of metal-doped atoms in BNC$_2$ results in the reduction of the band gap. The Al@BNC$_2$ monolayer has more robust interactions with gas molecules such as CO, CO$_2$, NO, and NO$_2$ compared to the Li@BNC$_2$, Mg@BNC$_2$, and BNC$_2$ ML. Adsorbed gas molecules act as charge acceptors for pristine and doped BNC$_2$ MLs. When analyzed with recovery time at various temperatures, the metal-doped BCN$_2$ has the potential to be developed as a gas sensor compared to pristine BNC$_2$. Additionally, metal-doped BNC$_2$ could likely be developed for gas capture purposes.

Keywords: adsorption, Metal doping, DFT calculations

Analysis of Gamma-Ray Spectra from Blazar 3C 454.3 with Fermi- LAT Space Telescope

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Blazar is a galaxy with a large black hole as a high-energy source, classified as an Active Galactic Nucleus: AGN. It is classified as a very-high-energy gamma-ray source (above 0.1 TeV) that emits intense radiation and has an extremely high luminosity. Blazars are characterized by relativistic jets that are directed in a direction away from the Earth. In this research project, the radiation emission processes of particles in the blazar 3C 454.3 between August 4 2008 and October 1 2023 will be investigated. Spectral data from the Fermi Large Area Telescope (LAT) will be used together with other radiation measurement instruments such as Swift and radio telescopes. The data are selected and divided into different energy ranges to calculate and analyze the spectrum of particles resulting from the energy loss of leptonic particles in processes such as synchrotron radiation and inverse Compton scattering, which are non-thermal radiation processes. Subsequently, the results were used to create a spectroscopic model to explain the particle radiation phenomenon, using the Markov Chain Monte Carlo (MCMC) algorithm for analysis. The results of this model are consistent with the spectroscopic data from the Fermi-LAT and other radiation measurement devices.

Keywords: Blazar, Synchrotron Radiation, Inverse Compton Scattering, non-thermal radiation

Red emission carbon quantum dots for necked eyes colorimetric and fluorescent detection of metal ion in water

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Carbon quantum dots (CQDs) have extensive attentions because of their have potential applications in various fields, such as bioimaging, biomedicine and photocatalysis. In this research, we synthesized CQDs with red emissions (R-CQDs) by using hydrothermal method in which the synthesis involved heating at $210^{o}C/10h$ and sulfuric as solvent. Typically, l-glutamic acid and o-phenylenediamine were used as precursors. In this way, the R-CQDs are 2-3 nm in mean size with strong red fluorescent under UV light. The photoluminescence (PL) spectra showed the emission spectra at approximately 400 and 700 nm. For ions detection, the fluorescence of prepared R-CQDs are selectively quenched after the addition of Cu^{2+} ion while no quenching with adding other ions i.e. Mn^{2+}, Cd^{2+}, Al^{3+}, Cr^{2+} and Fe^{3+}. Therefore, the present work provides an effective strategy to monitor the concentration of Cu^{2+} ions simultaneously in an aqueous medium using environment-friendly R-CQDs.

Zinc, strontium ions co-doped whitlockite and composites: Controllable synthesis, physico-chemical and biological studies

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Whitlockite (WH, $Ca_9Mg(HPO_4)(PO_4)_6$) is an important inorganic phase in human bones and has positive significance for bone reconstruction process. In this study, we designed and synthesized zinc and strontium co-doped WH $Ca_9M_{9-x}Mg(HPO_4)(PO_4)_6$, M=Zn, Sr composite with Polyvinyl alcohol/Chitosan hydrogel (WH@PVA/CS). Results revealed that the composite exhibited porous 3D-structure with micropore and have a compressive strength 70-75 MPa. In vitro biological assay revealed that the osteoblast-like UMR-106 cells attachment with growth and proliferation on the substrates surface, and the WH nontoxic behaviors were also improved.

Effects of External Applied Magnetic Field Frequency and Wave Form on Demagnetization

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The study delved into exploring the effects of waveform, frequency, and ramp rate of an external magnetic field on the demagnetization process of steel. Utilizing a function generator, a power amplifier and a Helmholtz coil, a maximum demagnetizing field of 3.67 mT was generated. It was observed that the remanence (B_r) of the steel demagnetized by a sinusoidal waveform was lower compared to that demagnetized by square and triangle waves. Furthermore, an increase in the frequency of the demagnetizing field correlated with a decrease in its demagnetizing ability. Intriguingly, the B_r of the steel exhibited relative insensitivity to the ramp rate of the sinusoidal and triangle demagnetizing fields. However, in contrast, the B_r of the steel decreased with a decreasing ramp rate of the square field.

Keywords: Demagnetize, Soft ferromagnetic, Helmholtz coil

Synthesis and characterization of Mn-Fe$_2$O$_3$ / rGO for Photocatalysts

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In this work, Fe$_2$O$_3$ and Mn-Fe$_2$O$_3$ were synthesized by adopting hydrothermal method, and Mn-Fe$_2$O$_3$ / x%rGO (x=10%, 15%, and 20%) were synthesized by adopting solvothermal method. Scanning Electron Microscopy (SEM) used to determine the morphology of Fe$_2$O$_3$ and Mn-Fe$_2$O$_3$ particles. The result observed that the particles are accumulate together. When Mn-Fe$_2$O$_3$ / x%rGO decorated with rGO the result showed that there are the Fe$_2$O$_3$ and Mn-Fe$_2$O$_3$ particles were distributed on the surface of rGO sheet. Moreover, X-ray diffractometer (XRD) used to study the structure of the samples. Fe$_2$O$_3$ was epsilon (ε) phase and Mn-Fe$_2$O$_3$ and Mn-Fe$_2$O$_3$ / x%rGO particles were alpha (α) phase. The Scherre's equation used to investigate the particle size. The results reported that the particles were decreased with the increasing of rGO sheet. In addition, UV-Visible spectrometer used to study the optical property and energy band gaps. In the results, the energy band gaps of Fe$_2$O$_3$, Mn-Fe$_2$O$_3$ and Mn-Fe$_2$O$_3$ / x%rGO were 2.80, 2.99, 2.77, 2.80, and 2.64 eV respectively. In the part of degradation, Fe$_2$O$_3$, Mn-Fe$_2$O$_3$ and Mn-Fe$_2$O$_3$ / x%rGO showed good result for degradation of methylene blue. The Mn-Fe$_2$O$_3$ / 20%rGO showed the highest efficiency.

Keywords: Degradation, photocatalytic process, reduced graphene oxide, efficiency

Quantum composite materials as an efficient electrodes for hybrid energy storage devices

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The construction of composite electrode materials that exhibit superior energy and power densities has stirred rigorous research on hybrid energy storage devices such as supercapacitors, batteries or hybrids. Herein, we have successfully designed carbon quantum dots (CQDs) and superparamagnetic hematite (Fe_2O_3) dots (QS) functionalized reduced graphene (RG) hybrid ternary composites (QSG) by the solvothermal method. The hybrid electrode material, QSG, showed interconnected porous with excellent conductivity and high specific surface can effectively facilitate electron and ion transfer. The well-distributed CQDs and QS further provide abundant active adsorption sites. The QSG hybrid electrode shows enhanced gravimetric capacitance values of 161.12 F/g at current density of 0.1 A/g. The present results demonstrate that CQDs and QS modified electrode materials may provide an important approach for the fabrication of high-performance battery-supercapacitor hybrid energy storage devices.

Magnetocaloric Effect in $Ni_{50}Mn_{37-x}Co_xSn_{13}$ Heusler alloys

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This study investigates the magnetocaloric effect in $Ni_{50}Mn_{37-x}Co_xSn_{13}$ Heusler alloys with varying cobalt (Co) contents, where x = 0, 0.5, 1, 1.5, and 2 atomic percent. These $Ni_{50}Mn_{37-x}Co_xSn_{13}$ alloys were prepared through a two-steps process, which involved induction melting at approximately 1200 °C for 10 minutes, followed by annealing at 900 °C for 24 hours with a heating rate of 5 °C per minute in sealed glass tube. The structural and elemental composition of these alloys were characterized using X-ray diffractometer (XRD) and electron microscopy equipped with energy-dispersive X-ray spectroscopy (EDS), respectively. The magnetocaloric properties of the synthesized alloy were analyzed using a vibrating sample magnetometer (VSM). The phase formation of all synthesized alloys corresponded to the Ni_2MnSn phase. The result of the elemental composition indicated that the analyzed composition of the synthesized alloy deviated from the nominal composition. The magnetocaloric properties of these alloys indicated that the increase in Co content led to rise in Curie's temperature. However, the increase in Co content did not directly influence the magnetic entropy change. The maximum magnetic entropy change was observed at x = 1 with a temperature of 42.5 °C and a maximum magnetic entropy (ΔS_{max}) of 1.10 $Jkg^{-1}K^{-1}$. These findings offer valuable insights into the development of advanced magnetic refrigeration materials and facilitate tailored alloy design to optimize refrigeration performance. Overall, this research contributes to a fundamental understanding of magnetocaloric phenomena in Ni-Mn-Co-Sn Heusler alloys and their potential applications in sustainable cooling technologies.

Keywords: Magnetocaloric Effect, Ni-Mn-Co-Sn alloys, Cobalt Doping, Magnetic Refrigeration, Energy Effciency

Green synthesis of GQDs-Ag/Au nanocomposites for sensitive electrochemical detection of ascorbic acid, dopamine and hydrogen peroxide

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In the present investigation, gold (Ag-GQDs) and silver (Au-GQDs) nanocomposites were synthesized using a simple chemical process, whereas GQDs were synthesized using pyrolysis. A UV-vis spectrometer was used to investigate the optical characteristics of GQDs, Ag-GQDs, and Au-GQDs to determine the ideal concentration for the synthesis of AgNPs and AuNPs. X-ray diffraction (XRD), transmission electron microscopy (TEM), and scanning electron microscopy (SEM) were used to study the morphology, structure, and composition of the materials. Furthermore, the synthesized nanocomposites are fabricated on the glassy carbon (GC) electrodes surface by using a hexamethyl diamine (HDA) linker to examine their electrochemical characteristics. In comparison to the bare GC, GQDs modified GC (GC/GQDs), and Ag-GQDs modified GC (GC/Ag-GQDs) electrodes, the Au-GQDs modified GC electrode (GC/Au-GQDs) electrode demonstrated higher electrical conductivity and electroactive surface area. Furthermore, investigations were carried out on the electrocatalytic activity of GQDs and their nanocomposite modified electrodes towards the reduction of hydrogen peroxide (HP) and the oxidation of ascorbic acid (AA) and dopamine (DA). The GC/Au-GQDs modified electrode demonstrated greater electrocatalytic activity towards the reduction of HP and oxidation of AA and DA than GC/GQDs, GC/Ag-GQDs, and bare GC electrodes owing to its higher electroactive surface area and electrical conductivity.

Keywords: graphene quantum dots, metal nanoparticles, cyclic voltammetry, impedance spectroscopy, electrochemical sensing

Dynamics of energy transfer pathways in the photosynthesis process

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Photosynthesis process It is considered important for plants to survive. It uses energy from sunlight to convert carbon dioxide from the atmosphere (CO_2) and hydrogen from water (H_2O) or other hydrogen sources into carbohydrate compounds or sugars and oxygen gas (O_2), which within the photosynthesis process has a transmission mechanism, energy on pigments in chloroplasts. In this work, the mechanism of energy transfer from one exciton state to another was studied. It uses a stochastic process to analyze the effects of environmental fluctuations and considers a non-equilibrium system. This shows that energy transfer within chloroplasts is controlled by parameters that appear to be continuous measurements. As a result, energy transfer follows the main path with the highest probability. that shows the factors that affect the efficiency of the photosynthesis process. This leads to an understanding of the factors affecting plant photosynthesis. It can be used to accelerate plant growth. and further developed for use in agricultural analysis.

Keywords: photosynthesis, energy transfer, non-equilibrium, stochastic process

Holocene paleoenvironmental change of Bangkok Clay in Samut Sakhon Province by evidence of foraminifera assemblages.

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Samut Sakhon Province is an area where the coastline has changed due to changes in sea level. The sediment core, 35 m depth, was retrieved in Chai Mongkol Subdistrict, Mueang District, Samut Sakhon Province for foraminifera identification and paleoenvironmental change investigation. This research aims to use foraminifera to indicate the paleoenvironmental change in Samut Sakhon Province during the Holocene. The foraminifera assemblages consist of 3 classes, 3 orders, 7 families, 12 genera and 37 species. The presence of species shows that all foraminifera are marine inhabiting mainly intertidal zone. The sedimentological analysis together with foraminifera are divided into 4 units. Unit 1 is light grey well sorted silty clay and fine grain sand with *Pseudorotalia indopacifica*, which represents subtidal environment. Unit 2 is red and yellowish-brown silty clay, found shell and plant remains which can indicate intertidal environment. Unit 3 is yellowish white silty clay with *Ammonia* spp. and *Elphidium advenum* which represents intertidal environment. Unit 4 is dark grey well sorted silty clay with *Asterorotalia pulchella*, *Ammonia* spp. and *Elphidium subin certum* which represents intertidal environment. Therefore, it can be determined that there is a change in sea level that affects coastal landforms. There are 4 phases of sea level changes. Phase 1, the sea water is at shallow sea level. Phase 2, sea water trangression. Phase 3, sea water regression. and Phase 4, the seawater has receded near the current coastline.

Geotechnical Properties of Quaternary Deposit in the Land Bridge Project

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Land Bridge is a transportation infrastructure development project that develops southern economic regulations linking the Gulf of Thailand and the Andaman Sea. This project will develop Chumphon Pier (Laem Riw), Lang Suan district, Chumphon province, to the new Ranong Pier (Laem Ao Ang), Mueang Ranong district, Ranong province, along with a route linking two piers, with a distance of approximately 90 kilometers. This research aims to study Quaternary sediment for use as construction materials, especially in road construction for the Land Bridge project, consisting of ten samples of sediment both collected in Chumphon province (i.e., Prao canal soil (Tk-1) and soil near Khon canal (Tk-2) from Thung Tako district, Laem Riw-1 soil (Ls-1), Laem Riw-2 soil (Ls-2), and soil near Kuan Sian Waterfall (Ls-3) from Lang Suan district, Lang Suan canal-1 soil (Pt-1), Lang Suan canal-2 soil (Pt-2), and soil near Pak Song canal (Pt-3) from Phato district, and in Ranong province (i.e., Khu canal soil (Rn-1) and Tha Hin soil (Rn-2) from Mueang Ranong district. Then, they tested for acquiring engineering properties (i.e., grain size distribution, fineness of modulus, Atterberg's limit, specific gravity, and compaction test. The results revealed that both Prao canal soil (Tk-1) and Lang Suan canal soil (Pt-1) did not reach the standard for subbase and granular material for concrete road surfaces but can be the only materials for the embankment. In addition, Laem Riw-2 soil (Ls-2) did not reach the standard for base and embankment but only passed the subbase, shoulder, and selected material standard. This makes Tk-1 and Pt-1 soils the most effective materials for the embankment, and Ls-2 soil is the most effective material for the subbase on the Land Bridge route in Chumphon province. Meanwhile, Tk-2, Ls-1, Ls-3, Pt-2, Pt-3, Rn-1, and Rn-2 soils did not reach the roadway standard, making them unsuitable construction materials for road works.

Keywords: Engineering properties, Construction materials, Roadway

Compare the specific composition of particulate matter (PM) in construction site

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Particulate matter contributes to air pollution and affects public health and the environment. The dust comes from many sources. The study aimed to compare the specific composition of particulate matter (PM) to find the source of the dust. For this purpose, dust samples were collected in the area of the Sukpracha Vajanon building of the Faculty of Science of Kasetsart University. The results of the analysis with the scanning electron microscope (SEM) and energy dispersive X-ray spectroscopy (EDS) as well as the analysis with the X-ray diffractometer (XRD). The analysis of the elements found in the dust from the study area revealed that most of the elements were iron, silicon, calcium, and zinc. The result is iron an essential material in construction, its ability to withstand heavy loads and strengthen other materials, next silicon is an important compound of concrete and bricks. and used in cement production, calcium as a building material (e.g. marble) and as a raw material for cement, and zinc as a building material for covering roofs and facades. Analysis of dust samples revealed that most of the elements found were used as building construction components.

Keywords: particulate matter**,** air pollution

Study of granitic rocks in Takua Thung district, Phang Nga province, Southern Thailand

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Granites in Thailand can be separated into three belts; Western, Central, and Eastern Granite Belt including I-type and S-type granites and distributed from North to South of Thailand. The study area is in Khao Hang Hong and Khao Po areas, Phang-Nga province, which belong to Western Granite Belt, are associated with tin-tungsten and lithium deposits. The aim is to study mineral compositions and chemical composition to understand the source of the granitic rocks. These samples can be separated into three types including granite (group 1), alkali-feldspar quartz syenite (group 2) and quartz monzonite (group 3). The granite of group 1 consists of quartz, K-feldspar, biotite, zircon and tourmaline and displays a poikilitic texture. The alkali-feldspar quartz syenite of group 2 is K-feldspar, quartz and muscovite, biotite, zircon and apatite. The quartz monzonite of group 3 is quartz, K-feldspar, muscovite, zircon and apatite. Whole-rock chemical composition of granites consist of SiO_2 ranging from 66.58 to 73.47 wt%, TiO_2 ranging from 0.29 to 0.56 wt%, Al_2O_3 ranging from 14.15-17.50 wt%, $T\text{-}Fe_2O_3$ ranging from 1.06-2.90 wt%, MnO ranging from 0.04 to 0.09 wt%, MgO ranging from 1.42 to 2.22 wt%, CaO ranging from 0.13 to 1.14 wt%, Na_2O ranging from 2.00 to 2.90 wt% and K_2O ranging from 5.42 to 7.52 wt%. The alkali-feldspar quartz syenite (group 2) is a lower of SiO_2 (61.19 wt%) and a higher of K_2O (12.5 wt%) than groups 1 and 3. These granites from groups 1 to 3 are plotted in the peraluminous magmas (Al_2O_3 and $CaO+Na_2O_3+K_2O$) and in the syn-collision (Y+Nb and Rb) areas. The granites from the groups 1 to 3 are S-type granite and occurred during the subduction between Sibumasu and West Burma terrane in Late Cretaceous age which is belonging to Western Granite Belt.

Keywords: granites in Khao Po, Phang Nga province, S-type granite

Characteristics of Au-Ag quartz carbonate vein in Chatree deposit

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The Chatree gold-silver deposit is in the Loei-Petchabun mineral belt, in central Thailand. Recently, the Chatree mine is a large open gold mine in Thailand including many open pits such as A-east, C-H, and D pits, and operation since 2001. The gold-bearing quartz veins are characterized by veins, veinlets, and network brecciated veins which are hosted in the Late Permian to Early Triassic volcaniclastic rocks. This research aimed to study the vein texture, and mineral assemblages including gold contents to understand the relation between gold and sulfide minerals. The gold-bearing quartz veins from C-H pit can be divided into four stages based on cross-cutting relationships and mineral assemblages. Stage I of quartz vein consists mainly of microcrystalline quartz with pyrite and a minor of electrum. Stage II of quartz veins are composed of quartz and pyrite with a trace of electrum. Stage III of quartz veins content of quartz with calcite, chlorite, pyrite, sphalerite, chalcopyrite, galena, arsenopyrite, and traces of electrum. Stage IV of quartz vein consists of quartz, calcite, and fragments of veins from Stages I to III with a trace amount of pyrite. Quartz textures are comb (Stage II), mosaic (Stage III) and brecciated (Stage IV). The veins from Stages I to IV are analyzed by SEM-EDS and micro-XRF, Au contents from four stages are related to As, Cu, Pb, and Zn, especially clearly showing in the Stage III of quartz vein. The occurrence of Au in the gold-bearing quartz veins is commonly related to As, Cu, Pb, and Zn such as the Huai Kham On orogeny gold deposit and the Zaylik-Sailar epithermal deposit. Based on mineral assemblage and gold content, the gold-bearing quartz veins mainly formed in Stage III and are related to pyrite, sphalerite, chalcopyrite, and galena at C-H pit in Chatree epithermal gold deposit, Thailand.

Keywords: gold-bearing quartz vein, Chatree gold deposit, sulfide mineral

Occurrence of Li-pegmatite in Khao Po area, Phang Nga province, southern Thailand

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Recently, lithium has been an important material of Li-battery in an electric car for the 20th century in a trend of green energy. Various minerals content of lithium such as spodumene, lepidolite, and petalite. Lithium pegmatite in Thailand is associated with peraluminous granite and pegmatite such as in Kanchanaburi and Phang Nga provinces. The study area is in Reung Keat and Khao Po area, Phang Nga province, southern Thailand. Thirty-five samples were collected from the drilling cores at Reung Keat and outcrop from Khao Po areas for petrography and chemical compositions using a polarized microscope, XRD, XRF, and SEM-EDS analysis. Paragenesis sequence of lithium pegmatite can be separated in to three stages; (I) fine-quartz, plagioclase, muscovite, microcline, tourmaline, cassiterite, apatite, xenotime, monazite, chlorite, kaolinite and illite; (II) fine-grained quartz, albite, plagioclase, lepidolite, cassiterite, tourmaline, muscovite, analcime, apatite, zinnwaldite, monazite, and xenotime; (III) coarse- grained quartz, albite, plagioclase, lepidolite, cassiterite, tourmaline, muscovite, sericite, analcime, apatite, zinnwaldite, monazite, and xenotime. The lithium minerals are mainly lepidolite, zinnwaldite, and analcime in stages of II, and of III, and have higher concentrations of Al, K, and Rb. Chemical compositions from the lithium pegmatite of stages I to III consist of SiO_2 ranging from 67.75 to 71.16 wt%, TiO_2 ranging from 16.44 to 21.60 wt%, Al_2O_3 ranging from 16.44 to 21.60 wt%, CaO ranging from 0.21 to 3.42 wt%, Na_2O ranging from 4.10 to 5.95 wt%, and K_2O ranging from 3.27 to 8.02 wt%. Trace element compositions have high Rb, Y, W, and Sn indicating that there are high xenotime, tungsten, and tin in stages II and III. These pegmatites are alkaline to subalkaline granite composition. The pegmatite of the stage II is mainly of lithium minerals such as lepidolite, zinnwaldite, and analcime, including rare earth minerals such as monazite and xenotime.

Keywords: lithium pegmatite, lepidolite, zinnwaldite, analcime, Phang-Nga province.

Rock engineering classification in the Land Bridge project

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The Land Bridge is a transport development project between the Gulf of Thailand and the Andaman Sea, composed of a transport route connecting both ports, which covers a distance of 90 kilometers, consisting of a motorway, railway, and pipeline. This study aims to evaluate the rock quality in the Land Bridge project area using the Rock Mass Rating (RMR) consisting of 5 parameters (i.e., Strength of intact rock material, Rock Quality designation (RQD), Spacing of discontinuities, Condition of discontinuities, Groundwater, and Orientation) and Rock Mass Quality (Q-system) consisting of 6 parameters (i.e., RQD, Joint set, Joint roughness, Joint alteration, Joint water reduction and Stress Reduction Factor (SRF))., featuring six stops (i.e., stop of mudstone (MCP), sandstone (SACP), limestone (LCP), slate (SLCP), and granite (GRCP) in Chumphon province, together with another stop of granite (GRRN) in Ranong province). The results revealed Carboniferous-Cretaceous rocks, Cretaceous igneous rocks, and folding and the Ranong fault groups in the area. The rating assessment of the RMR and Q-system are as follows: LCP, GRCP, and GRRN are classified as good rocks as their RMR and Q-system values are 73,12.3, 74,18.77, and 73,18.11, respectively. Meanwhile, MCP, SACP, and SLCP are deemed poor rocks as their RMR and Q-system values are 31,0, 31,0, and 37,1.07, respectively. The poor rocks 's properties in this area were influenced by the intrusion of Cretaceous igneous rocks and the movement of the Ranong fault group, causing the rock to have too many joint sets. Therefore, rock in Chumphon province is more suitable for foundation structures such as highways, tunnels, and railways, whereas rocks from Ranong province require full engineering support.

Keywords: Land Bridge, Rock engineering classification, Rock mass rating, Rock mass quality

The Influence of the Luster Quality of Freshwater Cultured Pearls.

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The luster of a pearl is one of the factors determining quality and price. Currently, assessing luster still requires expertise and experience, as the cause of the estimated luster remains uncertain. The study of the pearls' surface morphology using an Atomic Force Microscope (AFM) can be explained that a high luster pearl consists of orderly manner hexagonal crystal calcium carbonate ($CaCO_3$) in the form of aragonite. Study of the pearl thickness using X-ray radiography revealed that the high luster freshwater cultured pearl exhibit greater layer thickness compared to those low luster, that indicates a crystalline arrangement in the structure affects the pearl's luster quality. In addition, Energy Dispersive X-ray Fluorescence spectrometer (ED-XRF) was used to analyze internal elements, discovering calcium carbonate ($CaCO_3$) as the main component.

Keywords: Luster, Freshwater Cultured Pearls, Atomic Force Microscope (AFM)

Mechanical properties of metakaolin-based geopolymer concrete reinforced by bamboo fiber and perlite

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This study has the objective for study the mechanical properties of metakaolin-based geopolymer concrete reinforced by bamboo fiber and perlite based on bio-circular-green economy (BCG) policy. Therefore, waste alkaline solution or sodium hydroxide (NaOH) from metal plating factory was used as catalyze of geopolymerization reaction. As well as used bamboo which has been used as wave breaker at Khun Samut Chin, Samutsakorn was recognized as a prime option. Small pieces of bamboo were partially digested by alkaline solution 72 hr. to remove soft tissue from part of fiber before mixing raw material with the ratio 1%, 3% and 5% percent by weight. The ratio of metakaolin and perlite which has been heated at 800 °C is 1 kg. and 0.5 kg., respectively. Casting geopolymer material samples with mold size at 9 x 11 cm and curing the geopolymer with sunlight for 96 hours. Testing the compressive strength of the cured geopolymer in room temperature after 7, 14, and 28 days of curing. The results showed that the bamboo fiber ratio of 1% showed that the adhesion of the matrix samples at 28 days was better than 7 days same as the compressive strength. Therefore, this study represents another development of utilizing waste materials to beneficially increase the properties of geopolymer to be useful according to the BCG Economy model including Bioeconomy, Circular economy and Green Economy.

Keywords: Geopolymer, Metakaolin, Perlite, Bamboo fiber, Waste sodium hydroxide, BCG Economy model

Engineering properties of rocks for construction materials in the Land Bridge project

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Thailand has planned to construct an economic bridge known as the Land Bridge project to promote Thailand's economic growth and turn Thailand into a new maritime transport hub with two harbors connecting the Andaman Sea and the Gulf of Thailand. The Land Bridge project cuts through Ranong and Chumphon provinces approximately 90 kilometers, consisting of a highway, railway, and pipeline. Therefore, tons of construction materials are required during the project, as well as the tests for acquiring engineering properties. In addition, having sources of construction materials nearby is an advantage in terms of logistics conditions. Thus, this study aims to provide the sources of construction materials as rocks and their engineering properties to be used as railway ballast and coarse aggregate in highway construction. This study consists of four types and five samples of rock collected throughout the field investigation along the Land Bridge line and surrounding areas within 5 kilometers (i.e., granite-RN collected in Ranong province, and granite-CP, limestone, sandstone along with slate collected in Chumphon province). The engineering properties of rock samples were analyzed. The results revealed that only granite-CP could be used as railway ballast compared to the railway ballast standard in bulk density, bulk specific gravity, absorption, abrasion resistance, and soundness test. Moreover, regarding coarse aggregate, most rock samples are suitable for highway construction following the roadway standard, including abrasion resistance and soundness test, except for granite-RN and slate, which cannot be used with the surface treatment field. Consequently, its versatility makes granite-CP the most appropriate rock for the Land Bridge project.

Keywords: Land bridge, Construction materials, Ballast, Highway, Engineering properties

Recycling of Construction and Demolition Wastes for Construction Work.

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Due to rapid population growth and urbanization, construction activities have increased, generating enormous volumes of construction and demolition waste. This study investigates the construction and demolition waste used as recycled aggregate in concrete, divided into coarse recycled aggregate (size 3/8 inch.) and fine recycled aggregate (size 1-2.36 mm), and compared with natural aggregate. The test sample format is a cube shape, 15x15x15 cm3 , with curing times of 7,14,21,28 days. Ratio 1:2:4 (cement: coarse aggregate: fine aggregate), a total of 36 samples (3 replicates per treatment x 3 different material ratios x 4 different curing times) were tested for compressive strength of recycled aggregate concrete and natural aggregate concrete using the Schmidt rebound hammer. The rebound number (RN) and the compressive strength of the natural aggregate samples (NA) were 21-29 and 157.9-270 Kilogram/Square Centimeter. The coarse recycled aggregate samples (CRA) were 2 2 - 25 and 168.1 - 214 Kilogram/Square Centimeter. The samples using fine recycled aggregate (FRA) were 20-24 and 142.7-198.7 Kilogram/Square Centimeter. The result revealed that concrete's compressive strength efficiency is NA>CRA>FRA. When comparing the statistical values, the factor of curing time affected the rebound number increased with the curing time as follows: 13.29 (7 days), 19.61 (14 days), 22.75 (21 days), and 25.48 (28 days). The recycled aggregate gave rebound numbers that were not different from the natural aggregates. Moreover, the curing time takes more than 21 days to provide an excellent rebound number, which is not statistically different. The results show that recycled aggregate can substitute construction material. However, the compressive strength of the concrete obtained is suitable only for pouring concrete floors for walkways, which leads to reduced construction costs and can reduce the environmental burden by saving natural aggregates.

Keywords: Construction and demolition waste, Schmidt rebound hammer, Recycled aggregate, Curing time

Petrography and geochemistry of sapphire bearing basalt in Thailand

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Basalts are distributed from North to South of Thailand such as Chiang Rai, Lampang, Phrae, Phetchabun, Lopburi, Karnchanaburi, Burirum, Sisaket, Ubonratchathani, Chanthaburi and Trat provinces, however, there are only Cenozoic basalts related to sapphire occurring in Phrae, Phetchabun, Karnchanaburi, Ubonratchathani, Chanthaburi and Trat provinces. The aim of this research focuses on mineral compositions, textures and chemical compositions of basalt including xenolith in the Phrae, Phetchabun, Chanthaburi provinces to understand a source rocks and tectonic environment. Mineral compositions of basalts from three areas are mainly composed of olivine, augite and enstatite, plagioclase with minor of magnetite and ilmenite and displayed trachytic texture. Chemical compositions of three areas are composed of SiO_2 ranging from 48.8 to 49.72 wt%, TiO_2 ranging from 1.54 to 2.08 wt%, Al_2O_3 ranging from 15.15 to 16.8 wt%, $T\text{-}Fe_2O_3$ ranging of 7.48 to 9.97 wt%, CaO ranging from 7.48 to 7.43 wt%, MnO ranging from 0.13 to 0.16 wt%, MgO ranging from 7.97 to 9.75, Na_2O ranging from 3.54 to 4.96 wt%, K_2O ranging from 1.27 to 1.76 wt%, and P_2O_5 ranging from 0.17 to 0.94 wt%, while the SiO_2 of Chanthaburi province is 46.6 wt% and lower than two areas. The basalts from Chanthaburi are Hawaiite, basalts from Phetchabun is alkali basalt to Hawaiite and basalts from Phrae is Mugearite composition by SiO_2 versus Na_2O+K_2O. Based on the chemical compositions, these basalts occur in the within-plate basalt by the ternary plot of Ti/100-Zr-3Y, 2Nb-Zr/4-Y, and the diagrams of TiO_2 versus Zr. The basalts from Phrae, Phetchabun and Chanthaburi provinces are basaltic flow with occurred in the with-in plated setting.

Keywords: Sapphire bearing basalt, within-plate basalts, Chanthaburi province, Phrae province

Subsurface Geology in the Critical Soil Salinity Area by 2D Resistivity Measurement at Mueang Phia Subdistrict, Ban Phai District, Khon Kaen Province

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Salinity land is generally found in the northeastern region of Thailand which causes a crucial problem on land used for agriculture crop utility. Ground surface saline soil is affected due to subsurface strong salinity and shallow level of groundwater affecting significant land use and declines in crop productivity. The study area is located in Mueang Phia Subdistrict, Ban Phai District, Khon Kaen Province. The objectives are to investigate the subsurface geological and hydrogeological characteristics around salinity ground surface zone and to understand the occurrence of salinity soil in this circumstance by using 2D resistivity measurement. Ten survey lines of 600 – 800 meters length, were located for taking 2D resistivity measurement with designed Dipole-Dipole and Schlumberger configuration covering an area of about 1 km. x 1.5 km. (north of Ban Do Yai). Several data processing techniques were performed i.e. 2D inversion modelling in deep and shallow sections, 1D inversion modelling at the interested points, and resistivity mapping at various depths of 5, 10, 15, 20, 25, and 30 m. The result shows that most obtained data is quite low to very low resistivity (< 10 Ohm.m) which may indicate that salinity groundwater mainly found in this study area. 2D sections display higher salinity groundwater found in the western side area (where ground surface exists as paddy rice field.) and seem slightly less salinity in particular deeper portion at the eastern side, where found as critical ground surface salinity occurrence. different depths of resistivity mapping confirm low resistivity zone i.e. high salinity groundwater on the eastern side, where the shallow existence of rock salt found at about 80 m deep, indicated by 1D models. In conclusion, critical saline soil on the eastern side may be affected by high saline groundwater found on the western side and then move up to the east.

Keywords: soil salinity, Mueang Phia Subdistrict, 2D resistivity, 1D modelling, Resistivity mapping

Irradiated kunzite and their stability to light and temperature

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Kunzite is a type of gemstone that is commonly enhanced color by irradiation treatment. Most color of kunzite are colorless and light pink but color of irradiated gemstones are sensitive to light and high temperature, that make color faded when contact for long time. The objective of this research is testing which light will effect the kunzite color fading. Color of kunzite sample that use in this research is colorless and light pink. After color enhanced by gamma ray, all sample turn into green kunzite. Irradiated kunzite samples were heated to change from dark green to pale green color. Heat treatment of kunzite at 150 ℃ is a lowest temperature that can faded kunzite color in 1 hours. The result from analysis of UV-Vis Spectrophotometer show only tiny absorption peak of Fe^{3+} in colorless kunzite. The white light is the fastest factor than warm light and UV light to change the color of kunzite samples.

Keywords: Kunzite, Irradiation

3D Pre-Stack Depth Migration (PSDM) interpretation for structural evolution and paleo-stress development in Nimitz Field, Taranaki Basin, New Zealand

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Nimitz Petroleum Field is situated at the Taranaki Basin, offshore North Island at Northwest of New Zealand. The area presents a complex geological structure as a result of the convergence between the Australian and Pacific oceanic plates. The study is interpreted and analyzed on 3D Pre-Stack Depth Migration (PSDM) seismic reflector covering 509 km^2 via DUG Insight software. The interpretation could classify the geological packages into three phases as I) the Pre-rift phase or Basement (? Jurassic to Late Cretaceous) which is represented by H1 marker which is a period of basin opening with fault strike along NNE-SSW (σ3 along E-W). It could be stated that divergent was dominated due to the Gondwana break-up. II) the Syn-rift phase (Late Cretaceous to Oligocene) is continued of major NNE-SSW fault with a period of sediment deposition showing thickening-Thinning (wedge) character in H2 and H3 markers. The basin is developed as a consequence of Gondwana breakup and Tasman seafloor spreading. III) Post-rift phase (Oligocene to Quaternary) represented consistency thickness between H4-H5 markers with minor reactivated fault along the same direction. Since the basin could not observe inversion structure and/or folding, it can state that the field may not be interrupted by plate subduction. Moreover, interpretation of H2 marker which is developed in syn-rift phase could be dominated as high potential as direct lateral migration of hydrocarbon from source rock in the basin, it can illustrate the interesting 2 prospects. And the study can contribute to a better understanding of the geological processes in the Taranaki Basin and guiding future exploration efforts in the region.

Keywords: New Zealand, 3D seismic interpretation, Structural evolution, prospect potential

Role of beryllium affecting to heat treatment of blue sapphire

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Blue color in gem corundum is caused by color center of Fe^{3+}-Ti^{4+} with mixed acceptor states, explained with energy band gap. Beryllium heat treatment of blue sapphires turns them yellow through beryllium color center. Yellow beryllium heat treated sapphire samples from Kanchanaburi, Thailand; Mogok, Myanmar and Sri Lanka were chosen then analyzed using UV–Vis-NIR spectroscopy and XANES in combinations with Tauc plots of the UV-Vis absorption spectra. Trace elements of samples were measured by EDXRF and LIBS then heated under reducing conditions. Results show the oxidation state of Fe was confirmed as Fe^{3+} by XANES spectra, both in samples that change to a lighter yellow and to blue. Besides, absorption peaks of Fe^{3+}-Be^{2+} mixed donor states were still detected by polychromatic UV-Vis-NIR excitation spectra after heat treatment but their role is reduced as seen as the faded yellow color, although beryllium atoms are still present in the structure based on the LIBS results after heating. Therefore, an energy band model for Fe^{3+}-Be^{2+} mixed donor states decrease affecting to reduction in yellow color and Fe^{3+}-Ti^{4+} mixed acceptor states increase affecting to increment in blue.

Keywords: Beryllium heat treatment**,** Polychromatic UV–Vis-NIR, Energy band model**,** Blue sapphire.

Characteristics of Natural Diamonds, Chemical Vapor Deposition Diamonds and High Pressure High Temperature Diamonds

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The trend of purchasing diamonds in the world market has changed due to the current economic conditions. The emergence of synthetic diamonds using developed synthesis techniques and technologies has made them closer in resemblance to natural diamonds and more intriguing. The product method of synthetic diamonds has emit less carbon dioxide (CO_2) compared to mining natural diamonds, and they also have lower price than natural diamonds by up to 10 times. When these synthetic diamonds play a role in increasing the gem industry, highly accurate inspection and analysis to differentiate natural diamonds from synthetic ones are very important. In this research, analysis was conducted through basic processes such as birefringence patterns. Photoluminescence technique and FTIR spectroscopy, showed the different pattern that can distinguish synthetic diamonds from natural ones.

Keywords: Synthetic diamond, Photoluminescence, Birefringence pattern

Heat treatment of aquamarine from Tanzania

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Aquamarine is an inorganic gemstone in the beryl group, which has a blue color. The chemical composition of the Beryl mineral group is beryllium aluminosilicate [$Be_3Al_2(Si_6O_{18})$]. The color of aquamarine ranges from blue, light blue to colorless, yellowish blue and greenish blue. The cause of the color is iron (Fe) replaced aluminium in the structure, divided into Fe^{2+} which gives blue color and Fe^{3+} which gives yellow color. In the gem industry, aquamarine has been treated to improve the quality by heating. However, the Fe oxidation state relating to the color mechanism on aquamarine was still questioned. The purpose of this study is to analyze the causes of coloration in aquamarine before and after heat treatment. The method used in this study are X-ray Absorption Spectroscopy with *in-situ* heating and UV-Vis-NIR Spectrophotometer under varying atmospheric conditions. As a result, it is found that the color of aquamarine has been changed from light blue to blue after heated at 450 °C under an oxidizing atmosphere and reducing atmosphere. The Fe *K*-edge XANES spectra on aquamarine show that the proportion of Fe^{2+} oxidation state is increased after heat treatment. The UV-Vis-NIR spectra show the absence of Fe^{3+} absorption position as well as the presence of Fe^{2+} absorption position on aquamarine after heat treatment. The energy band model will be proposed for understanding the color mechanism on aquamarine before and after heat treatment.

Keywords: Aquamarine, Fe oxidation state, X-ray Absorption Spectroscopy, UV-Vis-NIR Spectrophotometer

Comparison of gamma irradiation and high energy electron irradiation on Mozambique ruby

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Ruby is a variety of corundum (Al_2O_3) showing red color. Mozambique is one of the important sources of ruby related to metamorphic origin. The red color of ruby is caused by Cr^{3+}, however, the light purple color is shown when the Mozambican ruby contains the Fe-Ti impurities. Nowadays, irradiation has been slightly applied to enhance the ruby samples in gem markets to eliminate the purple zone. By the way, it is rarely information to identify the irradiated ruby samples and describe the mechanism of irradiation affecting the ruby color. The purpose of this study is to analyze and to explain the cause of color in ruby samples from Mozambique before and after irradiation by the gamma-ray and the high-energy electron beam. The four ruby samples were divided into two sets including either gamma irradiation or high-energy electron irradiation. Then, the samples were analyzed with advanced gem instruments such as Munsell color index, Colorimeter, Gem microscope, Laser Raman spectroscope, UV-Vis-NIR spectrophotometer, Fourier Transform Infrared spectrometer, and Energy Dispersive X-ray Fluorescence spectrometer.

As a result, the irradiated sample from both gamma irradiation and high-energy electron irradiation shows that the intensity of the purple zone in the sample was decreased and the red color was increased. Then, the red color was tiny in intensity after the fading test. It can be concluded that irradiation could be a method for eliminating the purple zone of the ruby samples whether or not the gamma-ray or high-energy electron beam.

Keywords: Ruby, Irradiation, Gamma-ray, High-energy electron beam, Spectroscopy

3D Pre-stack time migration (PSTM) seismic quality enhancement by amplitude extraction attribute for interpretation and petroleum potential detection within Hawke's Bay Field, East Coast Basin, New Zealand.

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The Hawke's Bay petroleum exploration area is located on the eastern coast of the North Island of New Zealand, which is part of the forearc basin. Due to its diverse and complex geological structure, medium-resolution data is obtained. The 3D seismic wave data contains important information such as density, velocity, wavelength, and frequency. Various methods can be used to extract seismic amplitude or attributes to enhance the quality. Fractures were identified from the curvature and semblance in the H1 rock layer (Cretaceous-Oligocene), which corresponds to the time of passive margin sedimentation and gravity collapse. It was found that the faults related to this basin were oriented in a northeast-southwest direction. In contrast, faults in the H2 layer were oriented in multiple directions, including northeast-southwest, northwest-southeast, and west-east, corresponding to a period when forces from the movement of the Pacific plate subducted under the Australian plate. Evidence of oblique strike-slip faults with predominant movement occurring along a northwest-southeast direction was also observed. The stratigraphic trap was identified by the characteristics of ancient channels obtained from Spectral Decomposition in the H2 rock layer. The petroleum potential in terms of traps could be demonstrated from the H1 rock layer, where anticline traps and fault traps were identified. On the other hand, only fault traps were found in the H2 rock layer. By overlaying the geological structure layer with the Instantaneous amplitude of the 3D seismic wave data, areas with potential for fault traps in the Hawke's Bay petroleum exploration area were identified and displayed as anomalies.

Keywords: Attribute, 3D PSTM, East Coast Basin, Anticline trap, Channel

Shallow Groundwater System around Underpass Chiang Rai International Airport using Detailed 2D Resistivity Technique

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The underpass of the main road located at the entrance gate of Chiang Rai International Airport; Chiang Rai province encountered the leakage of groundwater into underpass structure which needed to continuous pump out. The purpose of 2D resistivity application to support engineering task for stopping inflow groundwater into the underpass is to constrain the inflow of shallow groundwater channel at eastern zone of the underpass. 2D resistivity field measuring along eight survey lines with vary length of 200 - 400 m, were designed by using Schlumberger configuration with electrode spacing of 5 m for the target depth of 35 m. The results found low resistivity zone (15-35 ohm-m.) which indicate as shallow groundwater channel presenting in two directions of flowing lines; from NW (from western mountain area) and SW (from Kok river) strike the underpass at north and south portion. Dimension of shallow groundwater flow into the underpass illustrated by resistivity mapping with vary depth of 5, 10, 15, 20, 25, 30, and 35 m, and 1D models, are about 20 m wide and 10-30 m deep. The figure and location of groundwater channel may be helpful for geotechnical engineering work for solving this case.

Keywords: water leakage, underpass, 2D resistivity, 1D modelling, Resistivity mapping

Characteristics and spectroscopic properties of natural and synthetic rose quartz

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Rose quartz is a pink, translucent mineral in the quartz group, which emerged in gem and jewelry market. Synthetic rose quartz is now created commercially in market. The identification of natural and synthetic quartz is an important process for gem industry and gem testing laboratory. This research systematically studied the characteristics and spectroscopic properties of natural and synthetic rose quartzes. The physical properties of natural and synthetic rose quartzes were quite similar. Natural and synthetic rose quartzes were observed under the gemological microscope, the horizontal striations on surface and needle inclusions were found in natural samples. Breadcrumb inclusion and 2-phase inclusions were observed only in synthetic rose quartz. Fourier Transform Infrared (FTIR) spectrometer showed the absorption peaks at 3595 cm^{-1} and 3543 cm^{-1} in natural and synthetic rose quartz samples, respectively.

Keywords: Natural rose quartz, Synthetic rose quartz, Spectroscopic properties

Geochemistry of HED achondrite (diogenite) as an indicator for identifying parent body

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Howardite, Eucrite, Diogenite, or HED meteorite is a group of achondrite. Asteroid Vesta, a differentiated asteroid, is believed to be a source of these HED meteorites, according to their mineralogy and geochemistry. Diogenite is an ultramafic rock that may have originated from lower crust or upper mantle of the asteroid Vesta. However, diogenites exhibit wide variation in trace elements, and their formation process remains unclear. This study investigates physical characteristics and chemical compositions of NWA 7831 diogenite compared with other studied diogenites, and their relationship to the potential parent body. The results revealed that NWA 7831 is a brecciated diogenite with a harzburgitic lithology, primarily composed of enstatite or magnesium-rich orthopyroxene. Wollastonite and pigeonite, with high calcium concentrations, are also found in the samples, while olivine is not present. Base on previous studies, wollastonite and pigeonite are not commonly found in diogenites. However, the comparison of Ni/Co ratio of NWA 7831 with other studied diogenites indicates that NWA 7831 has the same evolution as other diogenites, presented as a harzburgite. The result of this study suggests two possible formation processes for NWA 7831: (1) crystallization from calcium-rich magma in early stage and (2) fractional crystallization during the late stages of the magmatic ocean of asteroid Vesta. While the formation processes remain unclear, this study has provided more information on the variation in diogenite composition, which may lead to hypotheses on the evolution or formation processes of high calcium diogenites. Furthermore, the future study of rare earth elements (REEs) may reveal more insights into the fractional crystallization of NWA 7831.

Keywords: NWA 7831, Harzburgite, Asteroid, Vesta, Meteorite

Primary evaluation of fracture characterization and quality in basement reservoir by using 3D Pre-stack Time Migration (PSTM) seismic interpretation at Pipeline petroleum field in Taranaki basin, New Zealand

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The Pipeline oil field is located within the Taranaki basin in New Zealand where conventional sandstone reservoir is found in the syn-rift basin. Currently, the additional reservoir focuses on igneous or carbonate rocks, but it cannot present in all basins. While the basement could be a good reservoir and observe all the basins. Therefore, this study focuses on evaluating the quality of basements which generally have low porosity and low permeability, fracture induce good reservoir vice versa. Based on 3D seismic data, the basement can be divided into 3 zones and 6 sub-zones. These are the structures in the northern (A1, A2, A3), central (B1, B2), and interfault zone (C) structures. The study of connectivity characteristics, including the I, X, and Y nodes, to assess the potential for petroleum flow revealed that all prospect structures exhibited low values. In terms of fracture frequency, which is used to assess the quality of porosity in the area, from the values of P20 (fracture density) and P21 (fracture intensity), it was found that A1 has the highest values. This study found that fractures were not correlated with the main fault that opened the syn-rift basins. However, they were correlated with the geological processes of divergent plate movement along the northeast-southwest trend of the Tasman Sea during the Late Cretaceous period. Furthermore, it was found that the prospect structure C, which is located near the syn-rift basin, may have the best petroleum potential due to the fracture frequency and the distance for petroleum migration from the syn-rift basin.

Keywords: basement, fracture connectivity, fracture frequency, 3D PSTM, Taranaki basin

Earthquake impacts on Chiang Rai Province from the Phayao Fault and the Mae Lao Fault

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There are 16 active faults in Thailand that can cause earthquakes in the future. The active faults are mostly found in the northern and the western Thailand. Although Thailand is in the low level seismic hazard region, earthquake occurred frequently in the northern part of the country.

The purpose of this study is to evaluate ground motion and earthquake intensity that may occur from the Phayao fault and the Mae Lao fault in the area of Mueang District, Chiang Rai Province.

This study focused on Peak Ground Acceleration (PGA) of deterministic seismic hazard especially in Chiang Rai Province where the Phayao fault and the Mae Lao fault are located, therefore it is important to conducted the seismic hazard in Chiang Rai Province from the ground shaking due to potential earthquake. Analysis at depths of 5,10 and 15 kilometers by using the Maximum Credible Earthquake (MCE), surface rupture length (SLR) and ground motion prediction equation (GMPEs) from 32 fault segment data in the area. For the result, the Mae Khon fault segment is the most critical fault that can affect to Mueang District, with the Maximum Credible Earthquake of 6.8 M_w. This fault is 28 kilometers long and orientates along the northeast-southwest direction.

The maximum PGA at a depth of 5 kilometers is about 0.4307 g, at a depth of 10 kilometers is about 0.3362 g and at a depth of 15 kilometers is about 0.3100 g. The maximum PGA from the study is similar to the maximum PGA from the most moderate earthquake in Thailand. Thus, the study results can be used to prepare the community to reduce damage due to earthquakes in the future as well as to plan for the disaster recovery.

Keywords: Peak Ground Acceleration, Maximum Credible Earthquake, seismic hazard

Geochemistry of laterite in Si Thep city, Phetchabun province.

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Si Thep Historical Parkis an archaeological site of UNESCO, located in Phetchabun province, Thailand, which the site is constructed by laterite. The laterite has been a material and important for construction archaeological sites in the Thailand such as Sukhothai and Prasat Phanom Rung. The laterite is formed in tropical monsoon which can be divided into two types such as weathering and transported processes of sediment and igneous rocks. The research aim is to study the geology, mineral and chemical compositions of laterite to classify types and process of laterite in the study area. Geology of the Si Thep area is composed of Permian shale, Triassic basalt and Quaternary alluvial and terrace. Five samples from Si Thep area are separated into three groups such as the group I: dark reddish brown, consisting of goethite, quartz and hematite, types are pisolitic and nodule and the group II: dark reddish brown, consisting of goethite, quartz and hematite, types are pisolitic and nodule and the group III: very dusky red, consisting of kaolinite, goethite, quartz and hematite, types are nodule. Chemical compositions of the group I laterite consist of SiO_2 of 52.22 to 52.26 wt%, Al_2O_3 of 6.95 to 7.35 wt%, Fe_2O_{3t} of 38.73 to 39.41 wt%, while the group II is composed SiO_2 of 47.08 to 47.11 wt%, Al_2O_3 of 7.63 to 8.02 wt%, Fe_2O_{3t} of 42.43 to 43.08 wt% However, the laterite of group III is the higher of SiO_2 (64.23 wt%) and lower Fe_2O_{3t} (28.29 wt%) than the groups I and II. The plotted among SiO_2– Fe_2O_3- Al_2O_3 diagram indicated the groups I and III are weak lateralization, while the group II is moderate lateralization. According to the minerals and chemical compositions, the laterites in the study area are pisolite and nodule and form by transported processes indicated the source from sediment.

Keywords: Laterite, Si Thep Ancient site, pisolitic laterite, nodule

How Meteorological factors affect the amount of dust PM 2.5 in Bangkok During 2021 – 2023

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This research aims to investigate the correlation between PM 2.5 concentration in Bangkok and meteorological factors like wind speed, relative humidity, and temperature during 2021-2023. Another objective of this research is to analyze the trend of PM 2.5 concentration in Bangkok varied by seasonal factors. Khlong Toei Pier Meteorological Station and three automatic weather stations (AWS) provided meteorological data, while data on PM 2.5 concentrations were collected from four weather monitoring stations in Bangkok. We analyze the link between meteorological factors like wind speed, relative humidity, temperature, and PM2.5 dust concentration using data gathered from January 2021 to the end of November 2023. Analysis of PM2.5 trends in each season is completed, then compared, and used to make predictions of its following trends based on differences observed. The study's results at all four stations revealed a correlation between the hourly average of PM2.5 concentration and temperature. The PM 2.5 dust is most concentrated between 7 to 8 AM and is least concentrated between 2 to 3 PM. The temperature inversion that occurs in the morning causes the peak period as it reflects the movement of air and the dispersion of pollutants. When we look at the levels of PM 2.5 concentration in different periods throughout the year, the highest concentrations occur during the cold season then followed by the hot and wet seasons. Comparisons conducted using daily data found that the wind speed at each station has a direct correlation with the concentration of PM 2.5 dust. However, during the rainy season, the correlations of these months are dependent on the wind direction. In most situations, relative humidity has an inverse relationship with PM 2.5 concentration. The correlation between temperature and hourly PM2.5 dust concentration results in temperature inversion. During the cold season's months, hourly PM 2.5 concentration of these months is at the highest record of this study. The influence of relative humidity and wind speed even varies depending on the season and month and has inverse corrections with PM 2.5 concentrations.

Keywords: PM 2.5, Temperature inversion, Air pollution

Influence of Seasonal Factors on Heavy Metals Concentration in Estuaries of the Inner Gulf of Thailand

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Heavy metal pollution is an environmental problem in many regions, including the Inner Gulf of Thailand. Studies about the factors that affect the concentration of heavy metals are essential for understanding the trends in their accumulation, which impacts the ecosystem and human health. Thus, this study aimed to analyze the relationship between seasonal hydrodynamic factors (discharge) that affect the heavy metals concentration in estuaries of the Inner Gulf of Thailand, including Mae Klong, Tha Chin, Chao Phraya and Bang Pakong estuaries, by comparing the types and concentrations of heavy metals in seawater and sediment of each estuary between the dry and wet seasons. As a result of the analysis of 8 heavy metals in seawater (As, Cd, Pb, Cu, Cr, Zn, Fe and Mn) and 9 heavy metals in sediment (Hg, As, Cd, Pb, Cu, Cr, Zn, Fe and Mn), the concentration of Pb, Cu, Fe and Mn found in seawater samples during the dry season was higher than those in the wet season in all estuaries. The reason is that there is more discharge during the wet season that flows from the river into the sea than during the dry season. Therefore, it contributes to dilute the concentration of heavy metals in the water. In comparison, a trend of difference between seasons in the sediment samples could not be concluded. Analyzing the relationship between the concentration of heavy metals and the discharge that used the correlation coefficient found that the correlation could not be concluded statistically. However, comparing heavy metal concentrations in both seasons can determine that the discharge affects the heavy metal concentration in seawater.

Keywords: Heavy metal, Sediment, Seawater, Discharge, Inner Gulf of Thailand, Seasonal variation

Measuring background radiation levels around the Bangkok area to monitor and prepare for nuclear and radiation emergencies.

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Natural radioactivity is found almost everywhere around humans, whether from food, soil, water, and many other things. In addition, artificial radionuclides have been used in various ways in Thailand, such as medicine, industry, agriculture, and other fields. Therefore, humans have a greater or lesser chance of exposure to direct and indirect radiation. This study aimed to measure background radiation and prepare for different nuclear and radiation emergencies. It also includes comparing the radiation measurement performance of three instruments with varying sizes of probe: the Backpack Radioisotope Detector (ATOMTEX), the Backpack Radioisotope Detector (MIRION), and the Backpack Radioisotope Detector (Drone installation head) that were used to measure background radiation levels around important places where densely populated areas. A car-borne survey technique was also carried out around the city of Bangkok. The measurement results from all three devices were as follows: the Backpack Radioisotope Detector (ATOMTEX) obtained an average Dose rate equal to 0.080 µSv/h. The Dose rate obtained from the Backpack Radioisotope Detector (MIRION) was equal to 0.049 µSv/h, and the Dose rate obtained from the Backpack Radioisotope Detector (Drone installation head) was equal to 0.025 µSv/h. Compared to the value obtained from Atomtex, the dose rate obtained was the highest. The Second level was in Mirion, and the last was the Drone installation head. However, if the dose rate measured from all three devices is compared with the background dose rate of Thailand, it is still normal and not dangerous to the people.

Keywords: Natural radioactivity, ATOMTEX, MIRION, Drone installation head, a car-borne survey

Assessment Radiation Effective dose from Indoor Radon and Thoron in Tha Maka district, Kanchanaburi

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This research focuses on the measurement of Radon and Thoron gas concentrations indoors, which is the cause of lung cancer secondary to smoking. Sixty samples of RADUET with solid-state track detectors (CR-39) were installed in the dwellings of volunteers in Tha Maka district, Kanchanaburi. To detect alpha particles emitted by Radon and Thoron gas, a radioactive gas in an inert state accumulates in materials used to build houses, such as materials made from rocks, soil, and sand. When alpha particles run into the CR-39, there will be traces of alpha particles in the detector called Tracks, which have different sizes and depths due to the amount of energy from the alpha particles' interaction with the CR-39. The tracks formed on the detector are counted. The amount of gas concentration and the amount of radiation effective dose that the bodies of people in the area will receive per year are calculated. The Environmental Protection Agency (U.S.) has set the dangerous level of Radon gas to be 148 Bq/m3 or more. The average concentration of Radon gas inside buildings will be 40 Bq/m3, and UNSCEAR has determined that the average risk dose for the general public from breathing is approximately 1.2 mSv/y. From the results, it was found that A total of sixty samples had Radon and Thoron gas concentrations lower than 148 Bq/m3 that were not classified as dangerous, and four samples had effective doses of Radon higher than 1.2 mSv/y at an unsafe level, which may affect the body.

Keywords: Radon, Alpha particles, CR-39 detector

Evaluation of Radon and Thoron Progeny concentrations using a cascade impactor dust sampler in Tha Maka District Kanchanaburi Province

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This research aims to estimate the concentration of radon and thoron progeny. Breathing radon and thoron progeny entering the body may cause a risk of developing lung cancer by alpha and beta particle exposure. Assessment of the effective dose per year in each area is necessary to measure the impact on human health. Therefore, this research was conducted inside five volunteer houses in Tha Maka District, Kanchanaburi Province, for 24 hr. A cascade Impactor was used for separating aerosol particle sizes in the range of 10, 2.5, 1, and 0.5 μm at a flow rate of 4 L/min, used in conjunction with the track etching method involves the formation of marks on a solid state track detector (CR-39). To separate the emitted α particles from the progeny of radon and thoron. CR-39 detectors were covered with aluminum-vaporized Mylar film. According to the thickness appropriate to the alpha energy released by the radon and thoron progeny interacts with CR-39. All CR-39 detectors were chemically etched for 24 h in 6M NaOH solution at 60 ˚C, and the alpha particle trough density was counted using an optical microscope. In comparison, the AlphaGUARD radon monitor was installed with a cascade impactor in each area. The average equilibrium equivalent radon and thoron within research area buildings as measured by a cascade impactor for separating aerosol particle sizes were 1.9×10^{-5} Bq/m^3 and 3.63×10^{-6} Bq/m^3 compared with The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) standard values for radon and thoron in buildings at 148 Bq/m^3 which is below the standard. The average effective dose was 0.36 mSv/y must not exceed was 1 mSv/y and the natural radiation dose must not exceed 2.4 mSv/y, indicating that the results are at a safe level.

Keywords: Radon and Thoron Progeny, cascade impactor

Analysis of Heavy Metals in Organic, Non-toxic and Conventionally Grown Coriander Plants by X-ray Fluorescence Spectroscopy

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This research project investigates heavy metals presence in coriander plants grown through diverse methods: organic, non-toxic and conventional. The primary objective is to compare their heavy metal accumulation and determine which planting method results in higher levels. The heavy metals of interest are those specified by the Ministry of Agriculture and Cooperatives, including mercury (Hg), lead (Pb), cadmium (Cd), and arsenic (As). The distribution of heavy metals in various parts of coriander was examined, divided into above-ground and underground components. To conduct this analysis, a micro XRF machine, specifically the M4 Tornado model, capable of providing both quantitative and qualitative values, was employed. The research results revealed that none of the three planting methods detected the targeted toxic heavy metal. However, the presence of other metals, such as iron (Fe), zinc (Zn), manganese (Mn),copper (Cu) was detected. Consequently, it can be inferred that coriander samples from all three growing methods pose no significant hazard in terms of toxic heavy metal content. Regarding distribution, a notable difference between above-ground and underground levels was observed, with the accumulation of underground iron (Fe).

Keywords: Trace element, Heavy metals, Coriander plant, Micro XRF.

Study of Beryllium-7 and Other Natural Radionuclides from Particulate Matter

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This research project aims to investigate the specific activities of beryllium-7 and other natural radionuclides in particulate matter to assess annual inhalation doses. A total of 19 aerosol dust samples were collected over a 7-day period, from December 6, 2022, to August 1, 2023, using a high-volume air sampler installed on the 7th floor of Building 1, Office of Atoms for Peace, Chatuchak, Bangkok. The sampler is elevated 30 meters above ground level. The collected samples were then analyzed for the specific activities of Be-7 and other natural radionuclides using a high-purity germanium (HPGe) gamma spectrometry. The specific activities of those nuclides in PM2.5 dust were calculated, and the inhalation doses, representing the amount of specific radiation absorbed into the body, were calculated for Be-7 (447.6 keV), Bi-214 (609.31 keV) and Pb-212 (238.63 keV) in the adult male and female groups. The study findings indicate that the average specific radiation-absorbed doses in PM2.5 from the aforementioned radionuclides in the adult male group were 3.48E-09, 6.25E-11 and 1.14E-10 mSv, respectively. In the adult female group, the corresponding values were 3.01E-09, 5.42E-11 and 9.92E-11 mSv. In summary, the average annual specific radiation-absorbed doses from inhaling Be-7 and natural radionuclides into the body in both adult male and female groups are lower than the maximum radiation exposure recommended by the International Commission on Radiological Protection (ICRP), set at 1 mSv per year.

Keywords: Beryllium-7, Natural radionuclides, Particulate matter, Gamma spectrometry, Specific activities, Inhalation dose

Measuring Tritium Levels in Surface Water from Large Reservoirs to Gather Information on the Tritium Concentration in the Country's Surface Water Sources

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Measurement of radioactive contamination in water samples from various sources is essential to ensure the safety of water users for consumption. This research project aims to measure the levels of tritium in surface water from large reservoirs to gather data on tritium concentrations in surface water sources nationwide. The results will be used to assess the health risks for individuals using water for consumption and compare them with safety standards set by the International Commission on Radiological Protection (ICRP). Water samples were collected from all 14 reservoirs during the wet season period in October 2023, using a Kemmerer Depth Sampler. Tritium content was analyzed by the electrolytic enrichment method combined with liquid scintillation counting. The research findings reveal that the tritium concentrations in the surface water samples from the reservoirs range from 1.30-2.72 TU (0.15-0.32 Bq/L), which is lower than the allowable tritium levels in drinking water of 10 TU. When calculating the annual absorbed dose, it was found to be $3.13 – 6.67$ □Sv, which is lower than the safety standard of 1 mSv per year. Additionally, it was observed that the tritium concentrations in the water from all 14 reservoirs depend on geographical conditions, latitude, and elevation above sea level of the sampling locations. However, the tritium levels from all 14 water sources do not exceed the limits defined by the ICRP.

Keywords: Tritium, Surface water, Electrolytic enrichment, Liquid scintillation counter

Effects of gamma irradiation on the growth of mold in natural rubber films containing chitosan powder.

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Natural rubber films are commonly used in a variety of applications, including food packaging and medical devices. However, they are sensitive to microbial growth. Fungi, in particular, poses challenges in maintaining product quality and safety. Chitosan, known for its antimicrobial properties, shows promise as an additive to inhibit fungal growth in these films. Gamma irradiation effectively sterilizes rubber sheets and reduces mold. Overall, gamma irradiation of natural rubber films filled with chitosan powder combines the natural antifungal properties of chitosan with the sterilizing effects of gamma irradiation. This study explored the effect of gamma irradiation on the growth of mold in natural rubber films containing chitosan powder and evaluated their mechanical, morphological, and chemical properties, including % DD (percentage of degree of deacetylation). Natural rubber films were prepared with different contents of chitosan powder from 0 to 9 parts per hundred rubber (phr)and underwent gamma irradiation with different doses of 0 to 25kilograys (kGy). Fungal inhibition was assessed using the dilution method, while mechanical properties were tested using tensile properties. Structural and chemical changes were analyzed using SEM and FT-IR. The results revealed that the % DD of chitosan was determined to be 79%. Additionally, the number of fungal colonies formed tended to decrease with increasing contents of chitosan and radiation doses. Tensile testing indicated that the tensile strength (MPa)and elongation at break (%) values tended to decrease with higher chitosan contents and radiation doses, while the tensile modulus at 500% (MPa) increased with increasing chitosan contents. SEM analysis revealed changes in the morphology of the film surface, with a smoother surface observed at higher radiation doses. The FT-IR spectrum exhibited characteristic peaks consistent with chitosan, confirming its presence in the natural rubber films.

Keywords: Rubber films, Chitosan, Gamma irradiation, Mold, fungi.

Method validation for gross alpha and beta radioactivity measurement in water samples using a low level gross alpha/beta gas proportional counter

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The contamination of radionuclides in natural water can be a serious health hazard. The measurement of total alpha and beta radioactivity in water resources is necessary. Alpha and beta particles are classified as high LET radiation, leading to damage to human cells. The objective of the project was to examine the validity of the measurement technique of gross α and β in water samples using a low-level gross alpha/beta gas proportional counter. The acceptant criteria of the measurement parameters composed of the accuracy which compared between calculated values and Certified Reference Material (CRM), showing a Z-score < 2 and a relative error < 10%. The precision of the results obtained using ANOVA showed an F value lower than the F-test, therefore it was not significantly different. The water samples were prepared from deionized water and wastewater samples and mixed with calcium carbonate ($CaCO_3$). The measurement values showed that a relative standard deviation < 10% The detection limits for the analysis of the gross alpha and beta radio activities were 0.040 and 0.057 Bq/L, respectively. The results showed that the coefficient of determination R^2 was not less than 0.95, which was within the acceptance the criteria. Therefore, the results of the verification of all parameters showed that the method for measuring total alpha and beta radio activities in water samples using a low-level gross alpha/beta gas proportional counter was accurate and trustworthy.

Keywords: gross alpha/beta, low-level gas proportional counter, method validation

Development of natural rubber films containing gamma – irradiated fruit peel powder

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Fruit peels are considered abundant agricultural waste materials in Thailand, which can be used as antioxidants in natural rubber products. The objective of this research was to study and compare the antioxidant properties resulting from the oxidation reaction of gamma-irradiated fruit peel powder (FPP). FPP was derived from mangosteen peel powder (MPP) and pomegranate peel powder (PPP). These powders were irradiated with gamma rays, with varying doses of 0, 10, 20, 30, 40, and 50 kGy. Then, the fruit peel powders were used as fillers in natural rubber latex (NRL) gloves, with the additions ranging from 0, 3, 6 and 9 parts per hundred parts of rubber by weight (phr). Both types of fruit peel powders underwent examination for morphology, particle size, and total phenolic content. Additionally, NRL gloves were analyzed for morphology, color, and mechanical properties. The results indicated that their total phenolic content based on Folin-Ciocalteu method in FPP irradiated with various doses of gamma rays, ranging from 0-30 kGy, increased with increasing gamma doses. However, at the doses of 40-50 kGy, the total phenolic content of both FPP decreased. Subsequently, the materials were formed into rubber gloves through a dipping process. The study showed that the mechanical properties of the materials with the addition of FPP subjected to gamma radiation had higher overall values compared to materials without additives (0 phr). Tensile strength and elongation at break values exhibited a decreasing trend in comparison to the quantity of gamma radiation and the amount of additives added. In morphology testing, it was found that increasing the quantity of gamma radiation and additives led to a smoother surface compared to materials without additives (0 phr).

Keywords: Natural rubber, Fruit peel powder, Antioxidant, Mechanical properties

Effects of gamma irradiation on oil absorption and physical characteristics of eggshell powder

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This research investigated the effects of gamma irradiation on oil absorption and physical properties of waste eggshell powder. The study was conducted by gamma irradiation on eggshell powder with doses of 0, 2, 4, 6, 8, and 10 kGy. The irradiated eggshell powder was then determined for their functional groups using Fourier-transform infrared spectroscopy (FTIR) and morphology using Scanning Electron Microscopy (SEM). The thermal stability of the eggshell powder was analyzed using Thermogravimetric Analysis (TGA). The elemental composition of the eggshell powder was also determined using X-ray fluorescence (XRF) and the particle size distribution was measured using a Laser Particle Size Distribution Analyzer (PSD). The characterization on the properties of the irradiated eggshell powder revealed that gamma irradiation altered the eggshell powder's surface properties, increasing its surface roughness and numbers of pore with higher doses. Additionally, the oil absorption tests on engine oil showed that eggshell powder irradiated with 10 kGy exhibited the highest absorption efficiency, followed by the powder irradiated with 8, 6, 4, 2, and 0 kGy, respectively. Furthermore, eggshell powder irradiated with 2 kGy showed the highest efficiency for the absorption of diesel oil, followed by the powder irradiated with 6, 8, 10, and 0 kGy, respectively. Overall, the research demonstrated that gamma irradiation on eggshell powder could enhance the oil absorption capacity of the eggshell powder, which not only offers potential for actual applications but also provide interesting and effective method to utilize wastes from industries and agriculture to produce that new and valuable products that support the BCG economic model.

keywords: Eggshell powder, Absorption, Gamma radiation

Investigation of Crayon Artworks Through Micro-X-ray Fluorescence Spectrometry

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A study of artwork made with crayons using the micro technique. X-ray fluorescence It is a non-destructive analysis method. This will help in analyzing artworks in detail without having to collect physical samples. Because works of art made with crayons have distinctive and unique characteristics. which is sensitive to deterioration The application of the micro-X-ray fluorescence technique to the analysis of crayon artworks requires detailed study. The precision of elemental analysis makes this technique a high potential tool for studying the complex composition of various art materials. Including materials used in art using crayons. Unlike traditional methods, they often rely on physical sampling with the risk of damaging the artwork. The objective of the project is to study the elemental composition of art works using various brands of crayons using the micro-X-ray fluorescence technique and to evaluate the ability to identify the type of art works. Crayons The results of the study found that Micro-X-ray fluorescence technique Able to identify the types of elements in the artwork with crayons. Each brand has different elemental composition, making it possible to clearly analyze the artwork in each layer of the image with the different elemental compositions. However, the use of micro-X-ray fluorescence techniques to analyze crayon artworks is still a new field with room for research and development. There is room for improvement, especially in the application of this technique to crayon art. Integrating micro-X-ray fluorescence techniques into the study of crayon artworks. It is an interesting advancement in the field of conservation.

Keywords: Artworks, Micro x-ray fluorescence spectrometry, Crayon

Effect of gamma rays and heat on the degradation of natural rubber films containing fruit peel powder.

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Fruit peels are regarded as agricultural waste that substantially contributes to environmental pollution and global ecological problems. This project aimed to address these issues by utilizing waste fruit peel powder (FPP) obtained from mangosteens (MPP) and pomegranates (PPP) as a filler in natural rubber latex (NRL) gloves using a dipping process. Then the mechanical properties of the NRL gloves (both before and after exposure to heat and 25 kGy gamma radiation). were determined and analyzed. The findings indicated that heating and gamma radiation made the surface of NRL gloves rougher. Furthermore, the incorporation of fruit peel powder into the natural latex rubber gloves as a filler (3-9 parts per hundred parts of rubber by weight; phr) generally enhanced the tensile strength and elongation at the break of the specimens. Additionally, FPP also offered natural antioxidant properties, as demonstrated by the higher degradation coefficient values of the FPP/NRL gloves under heat or 25 kGy gamma degradation compared to the original NRL values. Furthermore, the accelerated aging of the FPP/NRL gloves with gamma radiation resulted in an increase in the tensile strength and elongation at break compared to non-aged or thermal-aged FPP/NRL gloves .When comparing the tensile strength and elongation at break of the developed FPP/NRL gloves to the specifications for medical examination rubber gloves according to the ASTM D3578-05, the recommended FPP content for actual glove production was 3-6 phr for MPP and 3-9 phr for PPP.

Keywords: Natural rubber, Fruit peel powder, Degradation, Mechanical properties

Development of oil-absorbent products from natural rubber foams containing gamma-irradiated eggshell powder

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This research investigated the development of an oil-absorbing product utilizing natural rubber foam added with gamma-irradiated eggshell powder. The study involved the determination of natural latex composites and eggshell powder exposed to gamma irradiation doses ranging from 0, 2, 4, 6, 8, and 10 kGy, combined with varying contents of 3, 6, and 9 parts per hundred parts of rubber (phr). The process involved vulcanizing natural latex with sulfur and sample preparation using Dunlop method. Various characterizations were conducted, including morphology examination via Scanning Electron Microscope (SEM), chemical composition analysis using Energy Dispersive X-ray Spectroscopy (EDS), and functional group inspection employing Fourier-transform infrared spectroscopy (FTIR). Additionally, the study assessed thermal stability of rubber foam using Thermogravimetric Analysis (TGA), as well as compression tests and hardness measurements density, surface wetting, and surface area/porosity were also determined. Oil-absorbing properties, reusability, and degradation were also tested. The results indicated that the morphology of natural rubber foam with gamma-irradiated eggshell powder featured an open-cell structure with calcium carbonate attached to the surface. The compression set and density were found to increased with increasing dose of gamma radiation, and increasing contents of eggshell powder. However, contrary to expectations, the study found that oil absorption rates decreased with higher gamma radiation doses but increased with eggshell powder contents.

Keywords: Natural Rubber, Gamma rays, Oil absorption

Analysis of the Distribution of Toxic and Essential Elements in Rice Grain Samplesusing X-ray Fluorescence Spectroscopy

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This research project aims to investigate and study the differences in the distribution of trace elements on the grains of various rice varieties, including Hom Mali rice, Brown rice, Sangyod rice, Sao Hai rice, and Riceberry rice. The goal is to analyze and compare the elemental composition of rice grains to indicate the different properties of each rice variety, highlighting variations in the distribution of elements on both unwashed and washed rice grains. This project utilized a micro XRF machine, specifically the M4 Tornado model, capable of providing both quantitative and qualitative data. The research results revealed that variations in rice species lead to differences in the amount of mineral accumulation in different parts of the rice grains, although the differences are not substantial. For instance, Brown rice exhibits an accumulation of minerals such as iron, calcium, copper, manganese, and zinc, particularly in the rice germ and along the sides of the rice grains. Hom mali rice, Sao Hai rice and Sangyod rice show significant mineral accumulation along the sides of the rice grains. Riceberry rice, on the other hand, displays substantial accumulation of potassium, copper and calcium adjacent to the rice grains. Additionally, there is a notable accumulation of elements such as zinc and iron around the sides and germ of the rice, with manganese particularly concentrated around the germ. Discrepancies in mineral distribution in certain locations are attributed to measurement angle, while the amount of elements depends on the distance between the rice grain and the probe due to variations in the rice grain depths. Regarding differences before and after washing with water, statistical analysis using a t-test at a significance level of 0.05 on Brown rice samples revealed that elements such as iron, potassium, calcium, copper, manganese and zinc had p-values > 0.05. This indicates that the amount of these elements in rice before and after washing is not significantly different.

Keywords: Elemental analysis, Rice grain, Micro XRF, Hom Mali rice, Brown rice

Utilizing Chat GPT for Enhanced Interpretation and Analysis of SPECT Thyroid Imaging

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The experiment conducted applies ChatGPT, an AI model, to analyze images of thyroid gland scans obtained through Single Photon Emission Computed Tomography (SPECT). Its primary aim is to assess the efficacy of ChatGPT in interpreting these SPECT images of the thyroid gland and to juxtapose its diagnostic accuracy against conventional methods with AI assistance. The process involves adapting the ChatGPT model to the specific environment necessary for importing and processing prepared datasets. These datasets comprise SPECT thyroid disease training data sourced from an open-access medical database. The ChatGPT model undergoes training with this dataset to familiarize itself with the patterns and characteristics of thyroid gland scans indicative of various diseases. Following the training phase, the model's performance is evaluated using a separate dataset known as the SPECT thyroid disease test dataset. This evaluation is crucial for gauging the model's diagnostic accuracy in identifying thyroid conditions based on scan images. Remarkably, the experiment reports an impressive accuracy rate of up to 97% in the model's analysis of thyroid gland scan images. Despite this high level of accuracy, it's emphasized that ChatGPT's application in this context isn't meant to replace medical diagnosis by professionals. Rather, it serves as a supplementary tool to assist medical practitioners in their diagnostic processes. Overall, the experiment underscores the potential of AI, particularly ChatGPT, in aiding medical image analysis. However, it also highlights the importance of integrating such technology responsibly within medical practice, ensuring it complements rather than supplants the expertise of healthcare professionals.

Keywords: Single Photon Emission Computed Tomography (SPECT), thyroid gland, imaging, Artificial intelligence (AI), Generative Pre-training Transformer (ChatGPT)

Detection of heavy metals and elemental composition in leaves of popular cannabis strains Sativa, Indica, and Ethos using X-ray fluorescence spectroscopy

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Cannabis has become a globally recognized plant with diverse applications across various industries, including alternative medicine, recreational use, and even food production, notably in regions like Thailand. Despite its widespread recognition and acceptance for medical purposes under the regulation of the Ministry of Public Health, recent scientific investigations have shed light on an unexpected concern: the potential contamination of commonly used cannabis strains with heavy metals. This revelation poses a significant risk to consumers, raising urgent questions about safety and regulation within the industry. In response to this emerging issue, this study aims to examine the presence of heavy metals and trace elements in three popular cannabis varieties—Sativa, Indica, and Ethos—cultivated in the Nonthaburi Province. Utilizing advanced Micro-XRF M4 Tornado technology, researchers conducted thorough analyses to determine the concentrations of key heavy metals. The results did not detect the presence of heavy metals such as Pb, Hg, Cd, and Cr. However, concentrations of Mn, Zn, and Fe were detected in the samples. Sativa exhibited concentrations of 1.45E-2 mg/g, 2.08E-2 mg/g, and 4.7E-2 mg/g respectively. Indica revealed concentrations of 1.9E-2 mg/g, 1.7E-2 mg/g, and 1.7E-2 mg/g, while Ethos showed concentrations of 2.5E-2 mg/g, 4.8E-2 mg/g, and 4.6E-2 mg/g respectively. It is worth noting that the concentration of heavy metals detected in the cannabis samples is relatively low. When compared to the allowable limit of 100 mg/kg for Zn in food, these findings suggest that the levels present in the cannabis strains are within safe thresholds. Nevertheless, the results from this research underscore the importance of continued monitoring and regulation of cannabis products to ensure consumer safety.

Keywords: Heavy metals, Trace elements, Sativa, Indica, Ethos, Micro-XRF

Effects of low-temperature plasma on seed germination and Growth of "*Ipomoea aquatica Forsk*."

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Water spinach, scientifically referred to as *Ipomoea aquatica Forsk*, is a leafy green vegetable that is rich in nutrients and has become increasingly popular among consumers, driving up the demand for its cultivation. However, low germination efficiency will affect the growth and yield of morning glory. Hence, the purpose of this study was to investigate the impact of cold plasma on improving the germination and growth of water spinach. Seeds underwent low-temperature plasma treatment with a micro-DBD plasma device, employing air gas at a flow rate of 1.5 Lpm for 0, 5, 10, and 20 minutes. Subsequently, the seed germination, growth development, and modifications to the seed coat were analyzed. The investigation unveiled that exposing seeds to plasma treatment for 10 minutes resulted in a notable enhancement in the percentage of seed germination to 95% compared to the control (0 min) around 85% germinated. Furthermore, the growth was improved after treatment plasma for 10 minutes which significantly increased the length, fresh and dry biomass of shoot and root, and chlorophyll content in the shoot and leaves of water spinach as compared to the control. Moreover, low-temperature plasma was observed to induce modifications on the water spinach seed surface, leading to enhanced hydrophilicity. This was supported by a considerable decrease in the water contact angle on the seed surface as the duration of plasma treatment increased. The discovery indicates that cold plasma technology has the potential to serve as a viable alternative approach in enhancing the seed germination and growth development of *Ipomoea aquatica Forsk.*

Keywords: *Ipomoea aquatica Forsk*, Low-temperature plasma, Seed germination, Growth development

Spatial Distribution of Heavy Metals in Biodegradable and Non-Biodegradable Disposable Food Containers Using Micro-XRF Technique

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The use of disposable food containers has raised concerns about their potential impact on human health and the environment. This study employed micro-XRF (X-ray fluorescence) techniques to investigate the spatial distribution and concentrations of heavy metals in biodegradable and non-biodegradable disposable food containers. Fifty samples, including containers made from materials such as bagasse, polylactic acid (PLA), wheat straw, polystyrene, polypropylene, and polyethylene terephthalate, were analyzed using a Micro-XRF M4 Tornado system. The results revealed that non-biodegradable containers, particularly those made from plastics, exhibited significantly higher concentrations of heavy metals such as iron (Fe) and zinc (Zn), with traces of chromium (Cr) and manganese (Mn). The spatial distribution of these metals was found to be inconsistent within non-biodegradable containers, suggesting potential issues with the manufacturing process and the risk of localized contamination. In contrast, biodegradable containers demonstrated a more uniform distribution of heavy metals, indicating a lower risk of localized contamination. Principal Component Analysis (PCA) and hexbin plotting further highlighted the fundamental differences in elemental profiles between biodegradable and non-biodegradable containers, while also revealing unique compositions and outliers. The findings of this study emphasize the need for stricter regulations, quality control measures, and the development of safer, sustainable alternatives to minimize the risk of consumer exposure to heavy metals and potential health hazards associated with disposable food containers. Further research into the leaching behavior of heavy metals under various conditions and the long-term environmental impacts of these containers is crucial to inform sound policy decisions and guide the development of next-generation food packaging solutions.

Keywords: Disposable food containers, Heavy metals, Micro-XRF, Biodegradable, Non-biodegradable

Research Methods for Extracting Samples of Metal Dust Contaminated with Cesium-137 Using a Solvent Rinse Method.

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This research focuses on the study of methods for extracting cesium-137 from metal dust samples contaminated with specific activity less than 6 Bq/g using a solvent rinse method. The extraction was tested with many factors, including the weight of the sample, the amount of solvent used, the temperature while blending, the time used for blending, and the hydrothermal process. A total of 20 experiments were performed. First, prepare the sample before extraction. The prepared samples were extracted using a vacuum glass filtration method. After extraction, metal dust and water samples were collected and measured with a gamma spectrometer. To see the concentration of cesium-137 before and after extraction, each experiment was repeated three times, and then the results from all experiments were summarized to find the extraction method that was most effective in extracting cesium-137. From the experiment, the results used to determine the extraction efficiency values were a total of 11 experiments from 3 factors: the results of the extraction of low-dose samples, the results of the extraction of intermediate-dose samples, and the results of the extraction of hydrothermal samples. From the research, it was found that the most effective extraction efficiency for low-dose samples (less than 1 Bq/g) was the extraction of metal dust samples weighing 1 kilogram. The most effective extraction efficiency for intermediate-dose samples (in the range of 1 to 10 Bq/g) was the extraction of metal dust samples weighing 2 kilograms. And the most effective extraction efficiency for hydrothermal samples was the extraction of metal dust samples at 120°C.

Keywords: Cesium-137, Gamma Spectrometer, Cesium Extraction, Contaminated Metal Dust

Qualitative Analysis of Heavy Metal Dynamics in Thai Rice Cultivation: Employing Micro-X-Ray Fluorescence Spectrometry to Elucidate Spatial Distribution Patterns

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Micro-X-ray fluorescence (micro-XRF) imaging was employed to investigate the uptake and distribution patterns of cobalt (Co) in germinating rice seeds of two varieties, KDML105 and RD6. Seeds were exposed to Co(II) solutions at concentrations of 10 ppm, 25 ppm, and 50 ppm for 24 hours to simulate potential environmental exposures. The micro-XRF analysis revealed that the radicle served as the primary site for Co uptake in both varieties, with RD6 demonstrating a higher affinity for Co accumulation across all concentrations than KDML105. As Co concentration increased, both varieties exhibited enhanced uptake and broader distribution within the seedlings. However, at the highest concentration (50 ppm), both varieties showed signs of potential toxicity or saturation, with decreased Co accumulation in the coleoptile. The influence of Co exposure on the distribution of other essential elements, such as calcium (Ca) and manganese (Mn), was also observed. The findings highlight the importance of genotypic variation in determining heavy metal tolerance in rice and contribute to developing strategies for cultivating rice in Co-contaminated soils. Furthermore, the study provides valuable insights into the physiological responses of rice to heavy metal stress and has implications for ensuring food safety and public health in the face of growing challenges posed by heavy metal contamination. Understanding the differential responses of rice varieties to Co stress during germination can inform the selection of varieties with enhanced Co tolerance and guide the development of sustainable agricultural practices in contaminated environments.

Keywords: Cobalt uptake, Rice germination, Micro-XRF imaging, Heavy metal tolerance

Effects of combined LED light and salinity stress on bioactive compound contents in Grammatophyllum speciosum

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Grammatophyllum speciosum Blume, commonly known as the Tiger Orchid, possesses medicinal properties utilized in traditional medicine. However, its natural scarcity and limited cultivation hinder its availability for commercial applications. Hence, there is an essential need for further research to enhance the yield of bioactive compounds from *G. speciosum*. This study aimed to quantify bioactive compounds in stem and root extracts of *G. speciosum* cultivated under the Temporary Immersion Bioreactor (TIB) system and assess the impact of combined stress (light + salinity) on compound accumulation and antioxidant activity. The results revealed higher levels of total phenolics and flavonoids in stem extracts (8.50 ± 0.38 mg GAE g^{-1} DW and 7.18 ± 0.35 mg QE g^{-1} DW), compared to roots (6.61 ± 0.45 mg GAE g^{-1} DW and 1.66 ± 0.34 mg QE g^{-1} DW). However, no significant differences were observed in plants subjected to various light-emitting diode (LED) colors with or without 100 mM NaCl. Stem extracts exhibited superior antioxidant activities, as assessed by DPPH, FRAP, and ABTS assays, compared to root extracts. These findings underscore the pharmacological potential of *G. speciosum* stem extracts. Nonetheless, the efficacy of combined light and salinity stress for enhancing bioactive compound production warrants further investigation, including the exploration of increased light intensity or alternate UV radiation types. This research signifies a step toward unlocking the therapeutic potential of *G. speciosum* and highlights avenues for optimizing its cultivation for medicinal purposes.

The Effect of Chitosan on The Synthesis of Bioactive substances in *Centella asiatica*

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Centella asiatica is an economically important plant extensively utilized in the food and pharmaceutical sectors owing to its diverse beneficial properties, including wound healing, anti-inflammatory, and antioxidant effects. This plant contains various bioactive compounds, notably phenolic compounds, flavonoids, and triterpenoids, which are of great interest for research and development in food and pharmaceutical applications. Thus, this study aimed to investigate the enhancement of bioactive compound content in *C. asiatica* through chitosan application. *C. asiatica* plants were initially treated with a chitosan solution at a concentration of 200 mg/L for 7 days under optimal conditions. Growth parameters such as leaf numbers were monitored throughout the experiments. Subsequently, bioactive compounds were extracted from the leaves using methanol and quantified using a spectrophotometer. Results revealed a significant increase in the content of phenolic compounds (201.06 mg GAE/g DW), whereas flavonoid and terpenoid contents showed a tendency to increase but did not significantly differ from the controls. Additionally, inducing stress by withholding water appeared to impact total phenolic content when compared to well-watered controls. This study suggested that chitosan serves as a potential elicitor for enhancing bioactive compounds in *C. asiatica*, rendering them safe and efficient for consumption due to their non-toxic and biodegradable nature. Furthermore, this data holds promise for application in various plant species for future development in the food and pharmaceutical industries.

Antioxidant activity of oil extracts from *Landoltia punctata* and *Wolffia globosa*

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Duckweed is the smallest and fastest-growing flowering plant globally. It is divided into 5 genera: *Spirodela*, *Landoltia*, *Lemna*, *Wolffiella*, and *Wolffia*. In Thailand, *Lemna*, *Spirodera*, and *Wolffia* genera are found. Due to its high accumulation of fat and protein, duckweed is popular in the food industry and used as a substitute raw material. Additionally, oil extracted from duckweed has been found to possess antioxidant properties and reduce cholesterol levels in the blood. Therefore, this research focuses on studying oil extraction from two duckweed species, *Landoltia punctata* and *Wolffia globosa*, to analyze their antioxidant properties using the Hexane extraction, Reflux and Fractionation methods. Experimental results showed that oil extraction yielded 32 milligrams from *Landoltia punctata* and 65 milligrams from *Wolffia globosa*. When analyzing the obtained oil for antioxidant activity using DPPH, it was found that *Landoltia punctata* oil could not be analyzed for scavenging percentage. However, oil extracted from *Wolffia globosa* showed an antioxidant inhibition percentage of 10.20 when compared to a positive control using vitamin C. Despite obtaining results for antioxidant inhibition in oil samples from *Wolffia globosa*, the analysis and extraction methods were found insufficient and unsuitable. Therefore, further refinement and optimization of the extraction methods will be conducted in future research endeavors.

Characterization of *Chlamydomonas reinhardtii* extracts for cosmetic purposes

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The problem of particulate matter (PM2.5) in the air is one of the significant issues. This type of pollution can have diverse impacts on our bodies, leading to both infectious diseases and various skin issues such as acne, dark spots, and premature aging. To address these concerns, this research explores extracts from different strains of the single-cell green algae *Chlamydomonas reinhardtii*. This algae species accumulates a substantial amount of carotenoids, which are potent antioxidants. This research study the basic properties and analyzes the antioxidant capabilities of the extracts, aiming to contribute to the development of cosmetics. The research involves monitoring the growth from the initial stages under normal conditions and inducing stress to stimulate the synthesis of antioxidants. The algae samples are then extracted, and their antioxidant properties are evaluated using the DPPH method. The results indicate that the stress-induced strain CC-4101, with increased heavy metal concentration, exhibits superior antioxidant abilities compared to the non-stressed strain CC-503. Furthermore, we study with the FRAP method to assess the antioxidant capacity. Strain CC-503 shows the highest activity in combating oxidative stress when induced by increased concentration of 3 nM zinc in form zinc sulfate ($ZnSO_4$) for 14 days. The induced stress with 3 nM zinc concentration resulted in higher antioxidant activity compared to ascorbic acid, with a value of 17.09 mg. The research also involves analyzing the phenolic compounds accumulated within the algae cells. Strain CC-503 is found to accumulate a higher amount of phenolic compounds compared to strain CC-4101. The maximum accumulation occurs when induced stress is applied by increasing the concentration of zinc at 3 nanomolars over a 14-day period. The accumulated phenolic compounds in this condition are comparable to 50.32 micrograms of gallic acid. The findings suggest the potential use of these algal extracts in the development of cosmetic products due to their substantial accumulation of phenolic compounds, a group known for its antioxidant properties, anti-inflammatory effects, protection against ultraviolet radiation damage, and anti-carcinogenic properties.

Effect of gamma radiation on crude protein pattern and total carbohydrate content in *Wolfflia globosa*

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Wolffia globosa (*W. globosa*), also known as "Khainam" is considered the smallest flowering plant and belongs to the Lemnaceae family, just like duckweed. *W. globosa* grows as a floating mat on water surfaces and is considered a superfood source from water bodies in Asia. Studies have shown that the dry weight of *W. globosa* consists of protein ranging from 34-45% (grams/100 grams dry weight) and accumulates a high amount of starch. Exposing various plants to gamma radiation induces changes at the molecular level. In this experiment, *W. globosa* was subjected to gamma radiation at different intensities. Protein extraction using the TCA-acetone method revealed that the sample irradiated at 50 Gray (Gy) had the highest protein content compared to other radiation intensities, with protein levels at 58.8 ± 0.09 milligrams. SDS-PAGE analysis did not show significant differences in protein patterns, with protein bands of sizes 15, 30, and 60 kDa present in all samples, including the non-irradiated sample. Carbohydrate analysis using the Phenol Sulphuric acid method showed that at the 50 Gray radiation level, the highest glucose content was found at 0.467 ± 0.02 grams, higher than in other irradiated samples. While the radiation response patterns on protein levels at different intensities were not clearly distinguishable, the experiment suggests that gamma radiation affects carbohydrate accumulation and protein quantity in *W. globosa* samples.

Keywords: *Wolfflia globosa*, gamma radiation, carbohydrate, crude protein

Study of ant-idiabetic and anti-inflammatory potential of
Pogonatherum paniceum (Lamk) Hack

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Pogonatherum paniceum (Lamk) Hack is a plant cultivated in Thailand. It is often used to make tea for relieving heat, diuretics, and reducing blood sugar levels. Research has found that *Pogonatherum paniceum (Lamk) Hack* contains numerous phytochemicals that can be used for medical purposes. Currently, the number of diabetic patients is steadily increased. Untreated diabetes can lead to complications, such as inflammation. Therefore, this project aimed to study the anti-diabetic and anti-inflammatory potential of *Pogonatherum paniceum (Lamk) Hack*. Dried and fresh *Pogonatherum paniceum (Lamk) Hack* were then subjected to hot and cold extractions. The results were evaluated based on the 50 percent inhibitory concentration (IC50) values. The study found that the dried leaves with hot extraction had the highest inhibition of alpha-glucosidase activity (IC50 = 552.85 ± 1.41 μg/mL), while the dried leaves with cold extraction showed the highest inhibition of alpha-amylase activity (IC50 = 718.50 ± 4.23 μg/mL). Moreover, Dried leaves with cold extraction demonstrated the best ability to inhibit albumin protein denaturation, with an inhibition rate of 11.46% at a concentration of 2000 μg/mL. Furthermore, it was observed that the dried leaves with cold extraction showed the highest inhibition of protease activity (IC50 = 1358.70 ± 3.12 μg/mL). In conclusion, the extracts from *Pogonatherum paniceum (Lamk) Hack* had significant anti-diabetic and anti-inflammatory potential. This could be beneficial for future studies about the treatment of diabetes and inflammation-related conditions.

In Vitro Evaluation of Antioxidant Potential of *Pogonatherum paniceum* (*Lam.*) *Hack.* Extract.

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Environmental pollution and metabolism in the body lead to increasing of ROS production. Free radicals can generate oxidative stress which destroys various systems within living cells and is the cause of chronic diseases. Nowadays, there has been growing interest in studying antioxidants from plants. *Pogonatherum paniceum* (Lamk.) hack (*P. paniceum*) is a perennial grass widely grown in Southeast Asia that has been used as traditional medicine. Previous research has indicated that dried *P. paniceum* leaves extracted from hot deionized water have antioxidant and anti-inflammatory activities. Therefore, this study aimed to investigate the antioxidant properties of *P. paniceum* extract by in vitro assays. The *P. paniceum* is categorized into two groups. The first group is fresh leaves and the second group is dried leaves. *P. paniceum* was then extracted using hot distilled water or cold distilled water. *P. paniceum* was assessed via total phenolics and total flavonoids. The results showed that dried leaves extracted from hot distilled water had the highest total phenolic and flavonoid contents. Then, *P. paniceum* extracted were evaluated the antioxidant capacity by DPPH free radical scavenging and metal chelating. The results were evaluated using the half-maximal effective concentration (EC50) value. Antioxidant results indicated that dried leaves extracted from hot distilled water exhibited the greatest DPPH radical scavenging activity (EC50 = 583.23 ± 4.57 μg/mL), whereas dried leaves extracted from cold distilled water exhibited the greatest metal chelating activity (EC50 = 575.31 ± 0.80 μg/mL). The antioxidant efficiency of *P. paniceum* extract was equivalent to standard ascorbic acid solution that used as a positive control. It could be concluded that *P. paniceum* extracts had antioxidant activities. This study may be useful in traditional herbal medicine which is currently gaining attention and is expected to become more popular in the future.

Development of silkworm virus detection by Loop mediated isothermal amplification

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The silkworm (*Bombyx mori*) is an economically important insect. Because the products from silkworms can be used to make a variety of products, including textiles and medical, etc. Farmers are concerned about the damage caused by the spread of disease among silkworms. In particular, grassery disease is caused by the *Bombyx mori* nucleopolyhedrovirus (*Bm*NPV). Silkworms infected with the virus will show symptoms between the fourth and fifth instar, which means that farmers will waste resources in raising the silkworms to finish their cycle. Generally, the detection of pathogens in silkworms uses the polymerase chain reaction (PCR) technique, but at present there is a Loop mediated isothermal amplification (LAMP) technique that takes less time and has higher specificity. The objective of this study is to develop the detection of *Bm*NPV virus by the LAMP technique. The researcher began by collecting virus samples and increasing the amount of *Bm*NPV virus. Then, silkworms that showed signs of infection were taken to extract DNA using an extraction kit. DNA virus was tested by the PCR technique to check the size of the gene fragment and the specificity of the designed primers. The viral DNA was then examined by the LAMP technique testing reaction times of 35, 45, and 60 minutes to find the appropriate time for the primers. It was then applied to detect the *Bm*NPV virus from the blood of silkworms. Upon examination of the virus by PCR technique, it was found that the extracted DNA was actually *Bm*NPV DNA virus and that the designed primers were specific to viral DNA. In testing the reaction time of the LAMP technique, the optimum time for each primer was found to be 60 and 45 minutes.

Keywords: silkworm (*Bombyx mori*), *Bombyx mori* nucleopolyhedrovirus, loop mediated isothermal amplification.

Genetic diversity of Bombyx mori nucleopolyhedrovirus of silkworm

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Bombyx mori nucleopolyhedrovirus or BmNPV, a rod-shaped virus that contain large double-stranded circular DNA genomes ranging from 80 to 180 kb in length. *Bm*NPV is the significant virus causing Grassery disease in silkworm. In this research, we studied the genetic diversity of BmNPV by collecting virus samples from three different sites in Thailand. The viral DNA is then amplified and extracted before being tested for purity and contamination. Next, use the universal primer to amplify genes for comparison. Find out, the extracted DNA was confirmed to have suitable purity and contamination values. A DNA band appeared that matched the selected primer. Following that, we analyzed the extracted virus DNA to identify the whole genome using the Nanopore sequencing technique and compared the results between the genome of BmNPV that we had examined in Thailand and the studies from other countries in Asia. Studying the genetic properties of the *Bm*NPV will allow us to analyze and investigate irregularities in the virus's genes that cause various diseases and symptoms in silkworms. This information can be utilized for future developments in various diagnostic aspects.

Alternation of enzyme activity by A407Q mutation of the α-glucosidase from Salivary gland of *Aedes aegypti*

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The α-glucosidase enzyme (EC 3.2.1.20, α-glucoside glucohydrolase; AGase) belongs to the group of enzymes involved in the hydrolysis of α-1,4-glycosidic bonds at the non-reducing end of substrates to produce glucose (α-D-glucose). AGase enzymes are commonly found in glycoside hydrolase (GH) families 13 and 31. AGase enzymes found in insects are classified under subfamily 17 (GH13_17). In mosquito saliva, GH13_17 AGase hydrolyzes sucrose from flower nectar into glucose (α-D-glucose) and fructose (β-D-fructose), which provide energy sources for mosquitoes to flight and reproduction. The sucrose preference has been reported that residues on conserved region II. But there is no report the residues on domain B'of GH13_17 AGase. In the study, the mutation at the position Alanine 407 to Glutamine in *Aedes aegypti* saliva AGase (*Ae*MalI) was studied. The recombinant enzyme of r*AeMalI_A407Q* was introduced into *Pichia pastoris* strain x33 and purified using a Nickel-Sepharose column chromatography. A total protein quantity of 0.03 milligrams and specific enzyme activity of 0.0183 μmole.min^{-1}.mg^{-1} of purified r*AeMalI_A407Q* were yielded in 200 mL culture broth. Analysis of the protein quality using SDS-PAGE after digestion with Endoglycosidase H (Endo H) revealed a protein size of 64 kDa. Enzyme activity assays using various substrates, including natural and synthetic sugars *p*NPαGlc showed the highest reaction velocity in sucrose more than maltose. However, no enzyme activity was observed in other disaccharides. The highest velocity was detected in maltotriose as observed in other GH13 AGase. The A407Q mutation seemed to lose enzyme activity in all substrates tested. But the mutant enzyme did not affect the specificity for sucrose hydrolysis and linkage specificity for α-1,4-glucosidic bond as observed in wild-type.

Development of biomaterials to enhance cell adhesion and growth

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Currently, there is significant progress in the fields of tissue engineering and regenerative medicine, which involve developing biological replacements to treat or regenerate damaged tissues or organs. One of the most popular type of biomaterials is alginate. However, alginate alone lacks biological signals for cell adhesion, necessitating the incorporation of gelatin to enhance cell attachment. The stable linkage between gelatin and alginate is through the formation of an amide bond using EDCI and NHS. Therefore, the aim of this research is to develop an alginate-based biomaterial that possesses L6 myoblast cell attachment activity for using as a 3D scaffold for tissue engineering cell culture. In the study, a carboxymethylation was used to increase carboxylic group on the sodium alginate's structure. Then, the conjugation between the carboxyl groups on alginate and amine groups on gelatin was performed via EDCI/NHS chemistry under differentiate conditions. Next, the cell adhesion and viability of L6 myoblast cells grown on the alginate-based biomaterial were examined using MTT assay. The results revealed that sodium alginate cross-linked with gelatin demonstrated a significant enhancement of cell adhesion and growth. Furthermore, the morphological study of L6 myoblast cells undergone differentiation to muscle cell was observed by fluorescence microscopy. The results demonstrated that all alginate-gelatin samples including sodium alginate resulted in the transformation of L6 myoblast cells into muscle cells after differentiation as evidenced by the multinucleated cell when stained with DAPI. Moreover, the gene expression of muscle cell markers in L6 myoblast cells grown on the alginate-gelatin including myogenin (*MYOG*) and myosin heavy chain (*MHC4*) were enhanced after the differentiation process, indicating an increase in the number of muscle cells. In summary indicate a successful of using gelatin-crosslinked sodium alginate as a biomaterial that could potentially be employed as a 3D scaffold for tissue engineering in the near future.

Keywords: Biomaterial, sodium alginate, gelatin, L6 myoblast

Identification of novel gene markers for osteoblast differentiation using bioinformatic and gene express analysis

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Bone is a connective tissue to which muscles are attach for movement. Osteoblasts are bone-forming cells that line on the bone surface. The osteoblasts create new bones by stimulating genes that control the bone development process. Bone tissue transplantation is a medical technology that uses bone tissues grafted to the desired area to stimulate new bone tissues. Stem cells are used to develop into bone cells. Several gene markers are used to indicate the bone development. Currently, there are many bone marker genes, such as alkaline phosphatase (ALP). This research aims to identify new novel gene markers used to determine the differentiation of osteoblasts using bioinformatic technology on the GALAXY platform. A public data set of MC3T3-E1 cells pre-osteoblast cells from mice, was transcriptomically compared with that of MC3T3-E1 cells that were differentiated for 3 days, 5 days, and 10 days with a criteria of a P-adj value less than 0.05 and a log2 Fold-change higher than 10. GALAXY analysis revealed that 5 days of differentiation gave 214 differentially expressed genes (DEGs), 111 up-regulated and 103 down regulated DEGs. In addition, the top 20 DEGs from 5 day differentiation possess the highest number of genes that have not been reported to associated with osteogenesis development. As a result, the DEGs from 5 day differentiation were of our interest and employed for function enrichment analysis using David bioinformatics. Also, protein-protein interaction networks within the mouse *Mus musculus* on the STRING website were investigated. The results showed that *ITSN1* and *CUL5* were the most two up-regulated DEGs and *AMOTL2* and *COL1A2* were the most two down-regulated DEGs with Log2 Fold-change of 24.89, 24.57, -27.73, and -27.15 respectively. Then, the expressions of these 4 genes were confirmed by qPCR using a differentiated MC3T3-E1 cell culture. The results demonstrated that the expression of *ITSN1* was increased by 1.231 folds, *CUL5* was increased by 1.784 folds. The expression of *AMOTL2* was decreased down to 0.695 fold, consistent with the transcriptome. Interestingly, the expression of *COL1A2* was increased by 10.593 folds, which was contradictory to the transcriptome analysis. In summary, three of the verified genes can be used as novel markers on the identification of osteogenesis in the future.

Keywords: Osteoblast, MC3T3, gene expression, GALAXY platform, Bioinformatic, Novel gene marker.

Selection of specific binding molecules for EpCAM, a colorectal cancer marker

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Colorectal cancer (CRC) is the leading cause of death in the world. Because most patients do not show symptoms in the early stage, cancer cells grow into a more severe stage. Therefore, the early detection will help increase the efficiency of treatment. This study then aimed to select a single-chain variable fragment (scFv) that specifically binds to Epithelial cell adhesion molecule (EpCAM), which is presented on the surface of colorectal cancer cells and circulating tumor cells (CTC). By using phage display in combination with bio-panning, the result showed phages that specifically bind to EpCAM peptides with more than 300 colonies. Among those, 60 colonies were randomly selected to perform colony PCR. Out of 60, 24 clones revealed the presence of phagemids (pMOD1-scFv) and were selected to investigate nucleotide sequences. The sequence analysis demonstrated that 11 clones did not have a stop codon. Among those, the phagemids scFv-Ep8, scFv-Ep54, and scFv-Ep59 were suitable for further analysis. The 3 scFvs were expressed and examined by gel electrophoresis (SDS-PAGE), Western blot, and dot blot techniques. Finally, the ability of scFv, in the whole protein extract, to bind EpCAM, compared with Human Serum Albumin (HSA) was investigated using ELISA technique. It was found that all those scFvs were able to bind to EpCAM better than HSA. However, *E.coli* strain HB2151 used in the experiment had insufficient protein production efficiency. As a result, it is not possible to conclude the results of selecting scFv that can bind specifically to EpCAM. Therefore, the phagemids scFv-Ep8, scFv-Ep54, and scFv-Ep59 should be transformed into a different host for higher efficiency of protein production and purification to enable further selection of scFvs that can bind specifically to EpCAM.

Partial purification of tropomyosin for allergy rapid test

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Seafood is rich in minerals and has a lower fat than other types of meat protein. Sea fish contains beneficial omega-3 fatty acids, which is rarely found in other meat. Crustaceans such as shrimp, crab, and shellfish are important mineral sources of iodine that affect thyroid function. They also contain vitamin B12 and zinc. Although seafood has many benefits, but also many people are allergic to seafood. Seafood allergy is caused by an abnormal reaction of the immune system of consumer. The main allergen in seafood is tropomyosin protein, which is a protein in muscles, responsible for controlling muscle contraction and relaxation. It has a size of 34-38 kDa and is two strands of fibers tangled together in a helix. It is rod-shaped with a length of 40 nanometers. It is very strong and durable. Although people are allergic to seafood, it is still difficult to obtain allergy tests.The testing methods used are skin prick tests and blood test for specific IgE. These two method are costly and time-consuming. However, if a test kit can be developed using the Lateral Flow Immunoassay test kit, it will reduce costs and time for inspection.This aim of this study was to develop a test kit for seafood allergy by using tropomyosin extracted and partially purified from white shrimp, which is a popular shrimp among consumers. Protein was precipitated by adjusting pH to isoelectric pH and used 30-50% ammonium sulfate. A partially purified sample of tropomyosin protein was dropped onto the membrane, which was immersed in solution containing specific antibody conjugated to tropomyosin with gold nanoparticles. It was found that the solution could flow on membrane and a purple band from the gold nanoparticles was noticible. When the buffer was diluted with the serum of a person, who is allergic of tropomyosin, the results can be visible to the naked eyes. That means, the purified tropomyosin protein from white shrimp was sufficiently pure to bind with tropomyosin-specific antibodies in the serum of allergic patient and display on the membrane.

The effects of *Cratoxylum formosum* crude extracts on the expression of apoptotic genes in breast cancer cells

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Breast cancer is currently a global public health issue and is the most common tumor in worldwide. It is a life-threatening disease in women and is a leading cause of death among them. Patients diagnosed with breast cancer may undergo various treatment methods such as targeted therapy, radiation therapy, surgery, and chemotherapy. Generally, treatment aims to improve the quality of life and increase the survival rate. However, unwanted side effects from breast cancer treatment, such as bilateral mastectomy, are one of the factors that stimulate the search for alternative methods. The use of herbs for breast cancer treatment is considered a natural alternative because some plants may contain properties that can naturally treat breast cancer. *Cratoxylum formosum*, commonly known as "teaw" is one such herb reported to inhibit the growth of breast cancer tissue. *C. formosum* contains a high concentration of phenolic compounds, such as 5-*O*-caffeoylquinic acid (5CQA), which has antioxidant activity, protects cells from oxidative stress, exhibits antibacterial activity, and shows anticancer activity. However, there have been no studies on the impact of *C. formosum* crude extracts on the expression of genes related to the apoptosis pathway in breast cancer cells. Therefore, this study aimed to investigate the effects of hot water crude extract of *C. formosum* on the expression of genes related to the apoptosis pathway in breast cancer cells using real-time Polymerase Chain reaction (PCR) technique. Due to the problem of aging and non-proliferation of breast cancer tissue culture cells, the research utilized normal tissue culture cells (Vero cells) as a substitute to study the optimal conditions for the PCR to increase the expression levels of *p53, bax, caspase3*, and *puma* with *beta-actin* serving as the reference gene. From the experimental results, it was found that RNA extracted from Vero cells is of good quality and purity, enabling the determination of optimal primer annealing temperatures for *p53, bax*, and *caspase3*. Additionally, it was found that *C. formosum* crude extracts at a concentration of 100 µg/mL tended to increase the expression levels of *caspase3* in normal cells. However, further experiments are required for accurate conclusions.

Keywords: Breast Cancer, Apoptosis, *Cratoxylum formosum*, Real-time polymerase chain

Fresh leaf extract from *Cratoxylum formosum* inhibits LPS-activated macrophages

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Cratoxylum formosum (CF) is a local plant in the Southeast Asian, which is used by local people as food and a traditional herbal. Previous reports have been revealed the extracts from CF leaves contain phenolic and flavonoid compounds, the phytochemicals having biological activities including an antioxidant, anti-inflammatory and anti-cancer in breast cancer. However, the effects of CF leaf extract on macrophages remains elusive. This study aims to study the anti-inflammatory activity of CF fresh leaf extract on lipopolysaccharide (LPS)-treated macrophages (RAW 264.7). To test the toxicity of extracts from CF fresh leaves on macrophages, we performed the MTT assay and found that the CF fresh leaf extracts at concentrations between 7.8 and 250 µg/ml exhibited no cytotoxicity to macrophage cells. Moreover, the concentrations of CF fresh leaf extracts at 15.6, 62.5 and 250 µg/ml effectively inhibited LPS-treated macrophages to produce nitric oxide, an important inflammatory mediator, by decreasing inducible nitric oxide synthase (iNOS) gene expression. All of the results suggest the potential of extracts from CF fresh leaves to inhibit the inflammation on LPS-treated macrophages.

Effects of *Cratoxylum formosum* Water Crude Extract on MicroRNA Gene Expression in Breast Cancer Cell lines

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Breast cancer is a major public health problem, being the most common cancer among women in Thailand and worldwide. Thai women have the highest death rate from breast cancer globally. Numerous risk factors contribute to breast cancer, including age, family history, hormones, genetics, and other variables. Preventing breast cancer is challenging due to its aggressiveness and ability to spread. Breast cancer treatment may require multiple procedures such as surgery, radiation therapy, chemotherapy, and hormone therapy, all of which can have side effects and are often expensive, making them difficult for patients to afford. Currently, phytochemicals are great interest because they have the potential to be developed into anticancer drugs. *Cratoxylum formosum* has been reported to have inhibitory effects on various types of cultured cancer cells, including liver and breast cancer. Previous studies have found that microRNAs (miRNAs) are regulators of gene expression and can lead to new approaches for diagnosis and treatment of diseases. Since miRNAs play an important role in the development of breast cancer, this study aimed to investigate the appropriate conditions for quantitative polymerase chain reaction (qPCR) to measure the expression levels of miRNAs (miRNA 21, miRNA 23a, miRNA 34a, and miRNA 99a) and to study the effect of hot water crude extract from *Cratoxylum formosum* leaves on the expression levels of these miRNAs in normal breast epithelial cells (Eph4) and breast cancer cells (MDA-MB-231). The results showed that it was not possible to extract good quality miRNAs from breast cancer cells. In addition, the cells were old and lack of growth, thus it was not possible to extract miRNAs again. However the miRNA extraction of normal breast cells was pure and of good quality, therefore it could be used to study the appropriate PCR conditions for miRNA 21 and miRNA 23a. Preliminary results of the analysis, the effect of *Cratoxylum formosum* leaf extract on miRNA expression levels using the $2^{-\Delta\Delta Ct}$ method showed that the hot water crude extract of *Cratoxylum formosum* leaves tended to decrease the expression levels of miR-21 and miR-23a in normal breast epithelial cells. However, further independent experiments are needed to confirm the correct results of this experiment.

Keywords: *Cratoxylum formosum*, Breast Cancer, miRNA, miR-21, miR-23a, miR-34a, miR-99a

Anti-Inflammatory Effects of Dry Leaves Extract from *Cratoxylum formosum* on Activated macrophage

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Cratoxylum formosum (CF) is a plant in the Hypericaceae family that is commonly found in Southeast Asia. Although the effects of CF extracts on anti-oxidative and anti-cancer activities have been reported, the anti-inflammatory effect of CF extract remains unclear. In this study, dry CF leaves were extracted by hot water after being crushed with liquid nitrogen and then freeze dry. The anti-inflammatory effect of dried CF leaf extract was studied on RAW 264.7, mouse macrophage cells. The cell viability of RAW 264.7 treated with CF leaf extract was investigated using the MTT assay. The results found that the concentrations of CF dry leaf extract at concentrations between 7.81-500 µg/ml did not affect cell viability. The ability of the extract to inhibit production of nitric oxide, a crucial inflammatory mediator, was studied by treating macrophages with lipopolysaccharide (LPS) and determined nitric oxide level secreting from activate macrophages by nitric oxide assay. The results showed that the concentrations of CF dry leaf extract at 250 and 500 µg/ml can inhibit nitric oxide production more than 80%. All the results show that dried CF leaf extract has potent anti-inflammatory activity in LPS-activated macrophages, indicating the promising use for inflammation-associated disease treatment.

Keyword: anti-inflammation, RAW 264.7, MTT assays, Nitric oxide assays, *Cratoxylum formosum*

Evaluation of vaccine efficiency and immune response
By commercially chemical adjuvant against streptococcosis disease

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Streptococcosis, a disease caused by Streptococcus agalactiae, as a major bacterial disease in tilapia culture worldwide. Vaccination is a widely accepted and recommended as an effective method for control *S. agalactiae* infection and prevent mass tilapia mortalities. Therefore, the use of adjuvant is necessary to increase that vaccine efficacy. This study is the investigation of the effectiveness of the commercial chemical adjuvant 'Montanide™ GR 01' with S. agalactiae bivalent vaccine (SA vaccine) for oral vaccine against Streptococcosis disease. The results of specific IgM antibody levels against S. agalactiae serotype Ia and III were observed to be higher in the GR01 vaccine (without SA vaccine) compared to the SA-Loaded GR01 vaccine. Real-time quantitative PCR results also showed that the highest immune gene expression of *TNF-α, IL-1β, TGF-β* and *IgT* in the spleens were significantly increased in response to SA-Loaded GR01 vaccine when compared to other groups. This determination shown potentially function of adjuvant in enhancing the innate and adaptive immune system in response to vaccination. Additionally, the growth performance of tilapia fish fed with GR01 vaccine showed greater growth performance compared to the other groups. With this, the highest specific growth rate (SGR) were observed as 5.75 ± 0.08 %/day. The feed conversion ratio (FCR) for the GR01 feed vaccine group was 1.69 g of feed intake the expected FCR range for tilapia fish. In conclusion, 'Montanide™ GR 01' has the potential for use as an adjuvant for fish vaccines against streptococcosis, as evidenced by the enhanced immune response and developed to control and prevent for tilapia aquaculture of streptococcosis disease for tilapia aquaculture.

The Study of Anti-Skin Cancer Activities and Cell Death Mechanism of the A431 Epidermoid Carcinoma by the Extracts from Orchid Hybrid

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Orchids have been used as folk medicines due to their important biological activities such as anti-oxidant, anti-inflammatory, and anti-cancer activities. This project aims to investigate the inhibitory effects of the extract from 2 orchid hybrids, *Dendrobium* Topaz Dream x *Dendrobium bigibbum* (DtDb) and *Ascocenda* Suksamran Gold x *Vanda* Pachara Delight (AV), on A431 skin cancer cells. The cytotoxicity of A431 showed that cell viability decreased in a concentration-dependent manner, and cells were very sensitive to both extracts when exposed to the extract at a concentration starting at 2.5 µg/mL. The rate of cell survivals significantly reduced and constantly remained at about 10% after incubation with the extract at 48 h. The inhibitory concentration on cell viability at 50% (IC_{50}) of DtDb and AV extract was 2.25 µg/mL and 2.04 µg/mL, respectively. Then cells were incubated with both extracts at a concentration of 2 µg/mL for the study of cell migration and cell apoptosis. It was found that both extracts significantly inhibited the migration of A431 cells when treated with the extracts at 48 h or more, comparing with the control group. The changes of DNA morphology, more condensed and fragmented, was observed by Hoechst 33342 staining, suggesting that DtDb and AV extracts may induce the cell death of skin cancer cells through apoptosis. This research reveals the potential of DtDb and AV extract for utilizing in medical and pharmaceutical fields in the future.

Keywords: *Dendrobium*, *Vanda*, Natural products, Functional ingredients, Skin cancer, Apoptosis

In Silico and *In Vitro* Structural Analysis of Tilapia Lake Virus (TiLV) Segments

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One of the popular fish aquacultures in the world is Tilapia which always cultivated in intensive system to maximize production yield. However, the drawback of this system is followed by enormous outbreaks and economic loss in more than 17 countries reported resulting from improper farm management and uncontrolled infectious diseases. Tilapia Lake Virus (TiLV) as known as Tilapia Tilapinevirus causes serious viral disease, affected to small fish, which generated up to 80% losses. TiLV is an enveloped, negative-sense single-strand RNA virus and contains 10 RNA segments that assemble into viral particles to induce immunogenicity. However, most of their genomes were unable to identify any specific biological function. On the other hand, TiLV segments were targeted of vaccine development such as segment 5 – 6, segment 8 and segment 9 – 10. Thus, this study focus on the *in silico* structural analysis of all those viral protein segments and determined their physicochemical properties including transmembrane prediction, secondary structure prediction, tertiary structure prediction and antibody epitope prediction. Apart from this, *in vitro* analysis was done to complete the recombinant protein expression and purification of TiLV segment 3 (67 kDa), segment 4 (58 kDa), segment 5 (25 kDa), segment 6 (28 kDa) and segment 7 (41 kDa). Those purified proteins will enabling precising protein structure analysis through CryO-EM or crystallization techniques. By which, the comparison of structure derived from *in silico* prediction and crystallization will proceed to characterization TiLV protein function in relatedness with protein structure. This information will increase effectiveness vaccine development protect TiLV in the future.

Keywords: Tilapia Lake Virus (TiLV), *In silico* structural analysis, Protein expression, Protein purification

Expression and purification of influenza A virus T-cell epitope in *E. coli* expression system

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Influenza is a highly contagious disease that causes mild to severe illness and leads to death in nearly half a million people yearly worldwide. Influenza virus is an enveloped virus with varied antigenic characteristics which can be categorized into 4 types: influenza A, B, C, and D virus. Among these, influenza A virus (IAV) can infect humans and animals. Genomics of IAV have been continuously mutated to change surface proteins, which is called antigenic variation that makes novel viruses spread quickly. To prevent influenza A virus infection, vaccination is the most important measure. Considering the importance of T-cells in stimulating broad-spectrum immunity against influenza virus infection, this research focuses on the production of influenza A virus (IAV) T-cell epitope in *E. coli* expression system, which is a guideline for further implementation of mRNA vaccine and providing certain characteristics of the protein expressed from that mRNA construct. Originally, the plasmid was designed for T-cell epitope production in the mammalian cell line system (pUC57_IAV). In this study, we described the successful cloning of the IAV T-cell epitope into pRUTH5 vector, which will encode for IAV T-cell epitope with N-terminal His6 tag and TEV protease cut site via ligation-independent cloning (LIC) method. The result showed that the protein cannot be expressed in *E. coli* expression system. We postulated that one of the reasons was from the designed construct harboring many unstructured linkers in the polypeptide of the IAV T-cell epitope. Concomitantly, the AlphaFold analysis showed that our protein construct has low pLDDT and the three-dimensional (3D) structure is also unstructured. We proposed that the protein construct without linkers may be able to be expressed in *E. coli* regarding its better folding stability and will be characterized for further mRNA vaccine candidate development, which must be further developed.

Keywords: Influenza, Influenza A virus, Influenza vaccines, T-cell epitope

Title Engineering of nicotine dehydrogenase for improving its efficiency

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Nicotine is an alkaloid compound that is an important component and can be found in high amounts in tobacco leaves. High levels of nicotine contamination can also be found in soil and fresh water. Nicotine is harmful to health and is the leading cause of death and disease in the world. In nature, nicotine dehydrogenase (Nox) is a bacterial flavin-dependent enzymes enzyme which catalyzes the oxidation of (S)-nicotine to N-methylmyosamine in the initial step of nicotine biodegradation. Generally, nicotine transfers electrons to FAD generating product and $FADH_2$. The electrons from $FADH_2$ were transferred to O_2 to be converted to H_2O_2. Previous research found that the reaction rate of electron transport to O_2 is very slow thus limiting enzyme efficiency. Consequently, this research will focus on increasing the efficiency of electron transport from $FADH_2$ to O_2 by site-directed mutagenesis through changing the amino acid residues at position Y210, W360, and Q362. Only two mutated plasmids, W360H and W360F, were successfully constructed. They were overexpressed in *Escherichia coli BL21 (DE3)* and were purified by Ni^{2+}-chelating affinity column chromatography. Due to the denaturation of purified W360H, only activity of W360F was studied further. The reaction between W360F and nicotine results in an increase of flavin oxidation rate compared with wild type. Thus, the change of tryptophan at position 360 to phenylalanine can improve the oxygen sensitivity which could speed up the nicotine degradation.

Investigation of roles of Amino acids in Active site of FMN-dependent quinone reductase

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HadB enzyme is bacterial quinone reductase in the pathway pesticides biodegradation It contains with flavin mononucleotide (FMN) as cofactor. To catalyze the reduction of quinone into hydroquinone. HadB also plays a role in detoxification and is involved in the response to oxygen-induced stress for bacterial survival. There has been no in-depth study on the function of amino acids important for acceleration due to the limitations in the three-dimensional structure data. The objective of this research to study the expression and investigation of the role of amino acids locate in the active site of HadB. There are 4 interesting amino acids, namely S43, F122, R123 and S147 to be altered by site-directed mutagenesis. Produce plasmids of six mutant enzymes i.e. S43V, S147A, S147V, F122I, F122V, and R123Q were successfully constructed. Only four mutants (S43V, S147A, S147V, and R123Q were expressed in *E.coli* BL21 (DE3) and were purified using Anion-exchange chromatography yielding HadB mutants with 21 kDa in subunit size. The purified S147A and S147V lack of FMN cofactor resulting in the loss of enzyme activity. This finding that serine position 147 is very important for FMN binding. Both quinone reductase and oxidase activities of S43V and R123Q were lower than that of wild-type HadB suggesting that they contribute in enzyme function. In addition, this work can roughly identify the role of these amino acid residues in HadB quinone reductase.

Keywords: FMN-dependent Quinone reductase, Flavin cofactor, Enzyme kinetic.

Selection of specific proteins binding to cytokeratin 20 (CK 20)

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Colorectal cancer (CRC) is one of the most common causes of death for people worldwide. Diagnosing colorectal cancer at an early stage, before it spreads, can significantly reduce mortality rates and increase survival chances. Therefore, a biomarker that is abnormally expressed in colon cancer cells for example cytokeratin 20 (CK 20) was measured by biopsy examination to diagnose colorectal cancer. This research thus aimed to select single-chain variable fragments (scFv) specifically binding to the peptide CK 20 using phage display and bio-panning techniques. Subsequently, the selected clones were screened using polymerase chain reaction (PCR) to amplify the scFv gene, followed by the extraction of the phagemid vector pMOD1 from E. coli TG1 for base sequence analysis. The amplified scFv genes were then transformed into E. coli HB2151 for protein expression. After that, the binding ability between scFv protein from whole cell extracts and CK 20 peptide was investigated using Enzyme-Linked Immunosorbent Assay (ELISA). In the first step, more than 300 colonies were selected from bio-panning and 60 colonies were randomly selected. It was found that there were clones CK20-18, CK20-28, and CK20-56 with complete V_H and V_L segments and a molecular weight greater than 20 kDa. The expressed scFv was then examined by SDS-PAGE and Western blot but there was no protein with a size of 30 kDa. ELISA results revealed that scFv could bind to the target at 37 °C better than at 4 °C and all three scFvs were able to bind to CK 20 better than human serum albumin. However, the uninduced clones were found to have similar peptide-to-albumin binding ratios to the induced clones. Therefore, it has not been possible to efficiently select scFv proteins that specifically bind to CK 20. Thus, the proteins will be produced in appropriate conditions by other bacteria and purified before further selection by ELISA.

Keywords: Cytokeratin 20 (CK 20), Biomarker, Phage display, scFv, Protein purification, Colorectal cancer, Bio-panning.

Engineering of nicotine dehydrogenase for improving oxygen sensitivity

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Nicotine dehydrogenase from *Pseudomonas putida* is a flavin-dependent enzyme which degrades nicotine. It most often uses flavin adenine dinucleotide (FAD) as a cofactor to catalyze redox reaction. In order to complete catalytic cycle, Previous research reported that nicotine oxidation in reductive half-reaction is very fast, however, the electron transfer to oxygen (O_2) in oxidative half-reaction is very slow thus limit the catalytic efficiency. In this research, we aim to improve O_2 sensitivity to increase the efficiency of nicotine dehydrogenase by enzyme engineering. Consider the three-dimensional structure of the nicotine dehydrogenase enzyme, two phenylalanine residues in the position 349 and 351 (F349 and F351) were targeted to be changed to non-polar amino acids with smaller sidechain. Using the Site-directed mutagenesis method, two mutated enzymes which are F349A and F349L were verified by DNA sequencing, while mutation at position F351 was not successful. After that, enzymes have been purified and used Ni^{2+}- IMAC Sepharose^{TM} 6 Fast Flow column. The enzyme activity was measured by UV-Visible Spectrophotometer at 450 nm over a period of 30 minutes. The change of absorption at wavelength 450 nm was monitored to observed rate of the change of redox state of FAD from reduced form ($FADH_2$) to oxidized form (FAD) when react with O_2. The result reveals that F349A has a higher absorbance than wild-type and F349L. Therefore, the catalytic efficiency of F349A toward O_2 was improved and will be studied further.

Keywords: Nicotine dehydrogenase, Nicotine, Enzyme engineering, Flavin, Oxygen sensitivity

Creating a triple mutant EGFR for enzyme activity comparison between the triple mutant, double mutant, and wild-type EGFR

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EGFR (Epidermal Growth Factor Receptor) protein is a transmembrane glycoprotein that plays a role in the growth and development of cells within the body. Mutation in the EGFR gene leads to abnormal expression of EGFR protein, resulting in the formation of NSCLC (non-small cell lung cancer) cells (van der Geer et al., 1994). Subsequently, the development of the first-generation TKI (Tyrosine kinase inhibitors) drugs, which effectively reduce the number of these cancer cells, ensued. However, prolonged treatment with the same drug can lead to the emergence of resistance, leading to the development of second-generation drugs capable of overcoming resistance to first-generation drugs. Currently, there are three types of TKI drugs available, all of which the cancer cells can resist (Lynch et al., 2004). In this research project, we focus on studying proteins by purifying them within the *E. coli* system to produce EGFR-Wild Type, Double mutated EGFR (T790M, L858R), and Triple mutated EGFR (T790M, C797S, L858R) proteins. We aim to determine the Kd (Dissociation constant) of these proteins with three types of TKI drugs (Erlotinib, Lapatinib, Afatinib) to elucidate their binding capabilities with each TKI drug. This data can be utilized for further studies or as part of the research efforts to combat NSCLC cells resulting from the mutation of EGFR proteins. The experimental results suggest that the TKI drug Afatinib exhibits the highest binding affinity with EGFR proteins among EGFR-Wild Type and Double mutated EGFR (T790M, L858R) when compared to Erlotinib and Lapatinib, likely due to structural reasons of Afatinib and these proteins.

Development and optimization of mesoporous particle loading with the bivalent aeromonad inactivated vaccine

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Bacterial diseases in fish are still a significant problem for the aquaculture industry. *Aeromonas* spp. is recognized as one of the severe pathogenic agents that causes devastating to the tilapia farming industry. However, to avoid the use of antibiotics, vaccination is one of the effective strategies to prevent bacterial infection. Moreover, utilizing an oral delivery system can feasibly facilitate the fish vaccination system instead of injection vaccination or boost immunity after the first vaccination. To develop and optimize vaccine delivery systems, herein, we are interested in the application of zeolite (ZSM-5) for carrying the vaccine. An inactivated whole-cell vaccine of *Aeromonas* spp. was produced and loaded to the ZSM-5 particles. The efficiency of vaccine loading efficiency (LE) was optimized by varying the concentration of ZSM-5 and buffer of bivalent Aeromonas inactivated vaccine. The sucrose gradient centrifugation and SDS-PAGE analysis were used to evaluate the vaccine loading efficiency. After that, the morphology and physical characteristics of the vaccine with ZSM-5 were investigated under scanning electron microscopy (SEM) and dynamic light scattering (DLS). The result showed that PBS pH 7.4 buffer with 15 mg/ml of ZSM-5 demonstrated remarkable bivalent Aeromonas vaccine loading. In addition, the releasing efficiency (RE) was determined in the *in vitro* mimicking digestive system. It demonstrated that ZSM-5 particles could protect the vaccine from the acidic condition (pH 2) throughout 7 h and could be released under the alkaline condition (pH 8 and bile salt) in a concentration-dependent manner.

Keywords: ZSM-5; Aeromonad disease; vaccine delivery system.

Identification of cDNA of tropomyosin of Red Frog Crab and Mangrove Crab by RACE PCR

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In Thailand, seafood is a common and widely consumed food. Crustaceans such crabs, are known to contain tropomyosin, an allergen that triggers allergic responses. Currently, no information is known regarding amino acid sequences of the red frog crab and mangrove crab. As a result, analysis of recognition sequence of the tropomyosin presents a challenge. Therefore, this work aim to identify the tropomyosin cDNA sequence in crabs. The rapid amplification to cDNA end (RACE PCR) approach was used to analyze the cDNA of the cicada crab, also known as the red frog crab (*Ranina vanima*) and Mangrove crab (*Sesarma mederi*). Oligonucleotide primers were designed from the partial data of the shrimp (*Euphausia pacifica*). The gene fragments of interest were cloned into a vector and transferred into bacterial cells of *E.coli*. Colonies were then selected by growing them in media containing ampicillin and gene fragments were examined by polymerase chain reaction (PCR), gel electrophoresis, and nucleotide sequence analysis. The analysis found that the RNA extracted from red frog crab and mangrove crab had a large amount of degraded RNA. However, partial nucleotide and amino acid sequence data were obtained. As a result, this experiment provides a partial cDNA information of red frog crab and mangrove crab. This information can be further use for analysis of tropomyosin for allergy study.

Keywords: Tropomyosin, Rapid amplification of cDNA ends (RACE), *Ranina vanima*, *Sesarma mederi*

Artificial intelligence for drug discovery against tyrosine kinase of JAK2 protein

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The JAK proteins, also known as Janus Kinases, constitute a type of enzyme belonging to the group of non-receptor tyrosine kinases. This group comprises four types of proteins: JAK1 – 3 and Tyrosine kinase 2. The function of these proteins is associated with the transfer of cytokines from cytokine receptors through the JAK-STAT signaling pathway, which is considered crucial for mediating extracellular signal transduction into cells, thereby inducing signaling cascades to promote cellular growth and intracellular responses. Consequently, in pharmacology, molecules are designed to inhibit the activity of proteins capable of causing diseases in the body, such as reducing pain, swelling, and inflammation resulting from immune system activity and diseases arising from abnormalities in blood cell production in the circulatory system.

This study focuses on the exploration of drug candidates derived from molecular data of herbal extracts against JAK2 proteins, comparing them with proteins in the same group, namely JAK1 and JAK3, utilizing Molecular Docking techniques on a computer cluster operating system. Experimental results, following data consolidation and comparative analysis of differences in sample types of herbal extract compounds against all three proteins, namely JAK1 (PDB ID: 6BBU), JAK2 (PDB ID: 3TJC), and JAK3 (PDB ID: 5TTS), reveal that among the top 50 compounds with the highest scores against all three proteins, ten molecules have been identified. These molecules include Salvianolic acid B, Tritetracontane, Tetratetracontane, β-Tocotrienol, β-pinene, Salvianolic acid L, Phenylmethyl ester, 9-cis-Neoxanthin and Nonioside F. This study thus demonstrates the potential for drug development from herbal extract compounds exhibiting inhibitory properties against diseases stemming from abnormalities in the Janus Kinase (JAK) protein group.

Keywords: Molecular Docking, Cluster computer, Janus kinase protein

Quantitative analysis of lipid in modified yeast

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Yarrowia lipolytica is an oleaginous yeast that has the ability to accumulate lipids. It makes this yeast to a potential source of fatty acids for biodiesel production. Previous studies have shown that the *SNF1* gene encodes a protein that belongs to the Snf1/AMPK family (AMP-activated protein kinase). This protein family is involved in the response to carbon source utilization in various organisms. Deletion of *SNF1* in *Y. lipolytica* leads to an increase in lipid accumulation inside the cells. However, the mutant yeast (Δ*snf1*) also showed defective growth on certain carbon sources. A previous study in our laboratory constructed a modified yeast strain (*ESL*) in which the expression of the *SNF1* gene was controlled by the *EYK1* promoter. The *EYK1* promoter is repressed by glycerol or glucose. Our aim was to create a modified yeast that could accumulate more lipids. In this study, we first investigated the growth ability of the modified yeast strain (ESL) compared to the wild-type (WT) and Δ*snf1* in different sugar sources as carbon sources to identify alternative carbon sources such as sucrose, fructose and xylose that can be used for lipid accumulation. The results showed that the ESL strain could grow on xylose, sucrose, and fructose as well as the WT strain. This indicates that even in the absence of the natural inducer of the *EYK1* promoter, the *ESL* strain can still control *SNF1* gene expression through other mechanisms. Next, we analyzed the lipid content of the *ESL* strain in media containing glycerol or glucose, From Nile red staining and fluorescence measurement, the results showed that *ESL* strain accumulated more lipid than the WT strain. To confirm the results obtained from fluorescence measurement, gravimetric analysis was performed to quantify the lipid content. From an optimization of condition for lipid extraction with organic solvents, the result demonstrated that increase of the extraction time led to an increase in the lipid yield. However, further studies are needed to optimize the conditions for lipid extraction from yeast.

Keywords: *Yarrowia lipolytica*, Lipid accumulation, *SNF1* gene

Site-directed mutagenesis and overexpression of EPSPS-4A from bread wheat

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Bread wheat (*Triticum aestivum* L.) is one of the most valuable food sources in the world. It is an allohexaploid (AABBDD) consisting of 3 sets of chromosomes (A, B, and D) with 7 chromosomes in each set, named as 1A, 1B, 1D through 7A, 4A, 7D. 5-Enolpyruvylshikimate-3-phosphate synthase (*epsps*) genes are located in 7A, 7B, and 7D. It is a crucial enzyme specialized for the synthesis of aromatic amino acids such as tyrosine, tryptophan, and phenylalanine and a target of herbicide glyphosate. In the previous research, *epsps-7A* was successfully cloned as a full-length sequence, while *epsps-4A* and *epsps-7D* were partially obtained. The missing part was proposed to be a signal peptide for transportation of protein into the chloroplast and was not involved with the enzyme catalysis. The amino acid sequence between EPSPS-7D and EPSPS-4A was found to be only one amino acid difference. Glutamic acid (E) was found in EPSPS-7D, while alanine (A) was found in EPSPS-4A at the position 189. This research aims to generate *epsps-4A* through site-directed mutagenesis using pET15b-*epsps-7D* as a DNA template. Nonoverlapping and overlapping primer pairs were used to alter nucleotide from G**A**G (*epsps-7D*) to G**C**G (*epsps-4A*). After increasing the extension time to 10 minutes in PCR cycle, the PCR products were transformed into *Escherichia coli* XL1 blue, isolated plasmid DNA, and sent plasmid samples to sequence. Based on nucleotide and amino acid analysis, it was found that clone 4OC3 and 4BC2 contained the desired mutation "GCG" which translates into alanine. Thus, this research successfully generated pET15b-*epsps-4A*. The pET15b-*epsps-4A* was then transformed into *E. coli* BL21(DE3) for induction and overexpression of protein using IPTG as an inducer at a concentration ranging from 0.0 to 0.5 mM at 37°C. It was found that, protein can be expressed the most at 0.5 mM IPTG but in the insoluble form. Bacterial cell growth induced with 0.5 mM IPTG was cultured at low temperature in comparison. It was found that EPSPS-4A can be expressed in soluble form more when induced bacterial cells with 0.5 mM IPTG and grown at both 18°C and 24°C for overnight. The optimal induction and overexpression of EPSPS-4A obtained in this study are useful for further steps in protein purification and for enzyme characterization in the future work.

Keywords: Site-directed mutagenesis, EPSPS, Induction and overexpression, Bread wheat

Biochemical characterization of transcription regulation by *Acinetobacter baumannii* HpaA

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Many bacteria are known to degrade environmental pollutants. This capability of breaking down of complex organic molecules into intermediates can be further used for utilization of alternative energy and carbon sources. *p*-Hydroxyphenylacetate (4-HPA) is an aromatic compound industrial waste that is also derived from bacterial metabolism of amino acids and biodegradation of lignin, the third most abundant biomass after cellulose and hemicellulose. *Acinetobacter baumannii* is one of those bacteria that contains HPA-degradation gene cluster, which can use *p*-hydroxyphenylacetate (4-HPA) as their carbon and energy source. *Acinetobacter baumannii* has gene cluster containing *meta*-cleavage operon, hydroxylase operon and two transcription factor encoding genes which is *hpaA* and *hpaR*. Here, this work focus on characterization of *Ab*HpaA in aspect of DNA binding properties to identify the target gene/operon in HPA-degradation gene cluster that controlled by *Ab*HpaA and demonstrate the transcription regulation by *Ab*HpaA via LacZ-reporter assay. From our study, electrophoretic mobility shift assay (EMSA) showed that *Ab*HpaA DNA binding domain (DBD) can binds to the intergenic region between *hpaA* and *meta*-cleavage operon, upstream region of the hydroxylase operon and upstream region of *hpaR* in the HPA-degradation gene cluster. This suggests that HpaA may control over the expression of *meta*-cleavage operon, hydroxylase operon, *hpaR* and *hpaA* gene, respectively. Besides, our preliminary LacZ reporter assay putting *lacZ*α gene under the control of the promotor of the hydroxylase operon showed that HPA can act as an inducer that stimulated the expression of LacZ. This can be implied that HpaA can function with HPA to induce the expression of hydroxylase operon in HPA-degradation gene cluster. Ultimately, this DNA binding characteristic of HpaA will be combined with its ligand binding properties to allow the fully understanding of transcription regulation of *Acinetobacter baumannii* HpaA.

Keywords: HPA-Degradation, AraC family of transcription regulator, Transcription factor

Characterization of transcription regulation by TphR from Comamonas sp. in response to TPA in GFP reporter assay.

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At present, many polyethylene terephthalate (PET) plastics are used, causing a lot of waste from this type of plastic. This is an important environmental problem; however, there are studies that this type of plastic can be degraded by the PETase enzyme to mono (2-hydroxyethyl) terephthalic acid (MHET), terephthalic acid (TPA) and bis (2‑hydroxyethyl)-TPA. Besides, MHET can also be degraded by the MHETase enzyme. The products of the reaction are TPA and ethylene glycol (EG). Although PET plastic can be degraded, the complete degradation of PET also depends on other biological mechanisms. One of the biological mechanisms is the TPA degradation process found in the bacteria *Comamonas sp*. stain E6. The bacteria can use TPA as a carbon and energy source as it has gene cluster that is involved in the degradation of TPA, including *tphR$_I$C$_I$A2$_I$A3$_I$B$_I$A1$_I$* and *tphR$_{II}$C$_{II}$A2$_{II}$A3$_{II}$B$_{II}$A1$_{II}$*. In both gene clusters, there are IcIR-type transcriptional regulators named TphR. The gene coding for TphR and the catabolic operon have a gene arrangement in the opposite direction. In the absence of TPA, TphR inhibits the expression of the operon causing the genes in the operon to be unable to express. In contrast, when there is TPA in the cell, TphR will bind to TPA and dissociate from DNA. This allows the catabolic operon to be expressed. For this reason, the main objective of the research team is to develop a biological sensor that can measure the amount of TPA within the cell. In this research, pET24a_TphR_sfGFP plasmid had been successfully constructed. This plasmid will be used to measure the amount of terephthalate (TPA) through the GFP reporter controlled by TphR. In addition, this research found that the terephthalate (TPA) compound does not affect the amount of GFP fluorescence signals in host cells with pET24a_sfGFP, in which there is no TphR within the host cell. Taken together, these results provide supporting information for further experiments measuring the amount of TPA within the cell harboring pET24a_TphR_sfGFP.

Keywords: TphR, PET, terephthalate (TPA), Biosensor

Effects of H256D and A338D mutation in *At*Bgl3B glycoside hydrolase from *Acetivibrio thermocellus*

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*At*Bgl3B glycoside hydrolase from the bacterium *Acetivibrio thermocellus* is classified as an N-acetyl-beta-D-glucose aminidase or NagZ because they share 70% amino acid sequence identity. Normally, NagZ enzymes exhibit a hydrolase activity, but past studies have found that *At*Bgl3B showed a phosphorylase activity toward *p*NP-GlcNAc. This research is interested in studying the mutation of the *At*Bgl3B enzyme at positions H256D and A338D A338D that may affect its activity toward *p*NP-GlcNAc and its phosphorylase activity. First, the mutant enzyme was generated by using the PCR-based site-directed mutagenesis method. Then the plasmid with the mutant gene was transformed into *Escherichia coli* BL21 (DE3), which was used to express the mutant *At*Bgl3B. After purification, the *At*Bgl3B_H256D mutant had a size of approximately 52 kDa and had no change in catalytic specificity. The kinetic properties of the *At*Bgl3B_H256D mutant toward *p*NP-GlcNAc were studied in the presence of 0-200 mM phosphate to investigate the effect of phosphate on the activity of the enzyme. It was found that the *At*Bgl3B_H256D mutant was able to catalyze the degradation of *p*NP-GlcNAc the best in the absence of phosphate. The V_{max} value of the *At*Bgl3B_H256D mutant in the absence of phosphate was the highest.

Characterization of *Acetivibrio thermocellus* beta-glucosidase lacking C-terminus (AtBgl3AΔCT)

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Beta-glucosidase is an important enzyme involved in biomass degradation through catalytic hydrolysis of cellulose digestion by breaking the beta-1,4-glucosidic bond of cellobiose to glucose. Glucose can be put into the fermentation process to produce renewable energy or biorefinery. Previous research found that AtBgl3A β-glucosidase from the bacterium *Acetivibrio thermocellus* (Accession number ABN52488.1) is a homodimer. Each subunit has an extended C-terminus that blocks the active site of the other subunit. In this project, we were interested in the role of this extended C-terminus. We then created a modified AtBgl3A without the C-terminus called "AtBgl3AΔCT" and compared its expression and activity with the wild-type AtBgl3A. AtBgl3AΔCT was purified by nickel affinity chromatography, to yield a single band at 79 kDa. The optimum temperature and pH for AtBgl3AΔCT activity were at 40 ℃ and pH 5.5, respectively. Regarding its temperature and pH stability, AtBgl3AΔCT showed at least 80% activity at temperatures lower than 50 ℃ and at least 80% activity in the pH range 4-9. Furthermore, AtBgl3AΔCT had high activity after incubation at 40 ℃ for 120 minutes. The kinetic analysis showed that AtBgl3AΔCT exhibited higher efficiency in the hydrolysis of *p*NP-Glc than *p*NP-Xyl, *p*NP-Gal, *p*NP-Ara, and cellobiose. When used in cellulose degradation, both AtBgl3A and AtBgl3AΔCT were three times better than the commercial cellobiase in the hydrolysis of cellulose to glucose.

Expression analysis of Snf1 in modified yeast

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Yarrowia lipolytica is an oleaginous yeast that has been used to research for studying lipid accumulation. From previous research, *Y. lipolytica* has Snf1 protein that plays a role to be a regulator of lipid accumulation. Our laboratory has aimed to develop the yeast strain to have more lipid accumulation. Therefore, a modified yeast was constructed to have a conditional repression for regulation of gene *SNF1*. ESL is a modified yeast that has the expression of *SNF*1 under the control of *EYK1* promoter to be a regulator of gene *SNF1*. The *EYK1* promoter can be repressed by glucose or glycerol. In the first part of this research, the growth analysis of ESL was analyzed in different carbon sources for use in alternative carbon sources in lipid accumulation. From serial dilution with alkanes and alcohols as the sole carbon source, the results showed that ESL was able to grow in all carbon sources but obviously defective. The results demonstrated that *SNF1* was expressed under the control of *EYK1* promoter even though erythitol or erythrulose, natural inducers for *EYK1* promoter, were not supplied in media. In the second part, the expression of *SNF1* with difference conditional repression was performed by western blot technique. The results showed that the expression of *SNF1* was repressed by glucose more than that by glycerol at 1 day of cultivation. Thus, conditional repression needs to further optimize a suitable condition for lipid accumulation.

Production and purification of Nylonase C from *E. coli*

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Nylon or Polyamide is synthetic polymers formed through condensation polymerization between dicarboxylic acid and diamines. Nylon possesses properties such as strength, flexibility, and resistance to heat and chemicals, making it a suitable replacement for natural fibers like wool and silk. However, nylon is so durable, nylon takes decades to decompose. To address this issue, a recombinant protein capable of digesting nylon, known as 6-aminoheanoate-oligomer hydrolase (NylC, EC 3.5.1.117), was produced from *Agromyces sp*. biodegradation of nylon involves the use of microorganisms. However, challenges arose when the recombinant protein produced in bacteria formed insoluble aggregates, or inclusion bodies, due to protein overexpression and misfolding. Chaperone proteins play a crucial role in aiding protein folding during and after synthesis, preventing protein aggregation, and increasing protein solubility. Therefore, this research focuses on producing and purifying recombinant NylC protein while co-expressing chaperone proteins GroEL/GroES, DnaK/DnaJ/GrpE, and Trigger factor, using *E. coli* strain BL21(DE3) as the host cell. The protein was induced with 0.4 mM IPTG at 30°C for 3, 6, and 20 h. Expression of the recombinant NylC protein was examined using SDS-PAGE and Western blotting. Expression of recombinant NylC protein was detected in the cell pellet. However, when the NylC was co-expressed with chaperones under 0.4 mM IPTG at 30°C for 3 h, a higher proportion of the protein was found in the soluble fraction, particularly when co-expressed with the chaperone protein DnaK/DnaJ/GrpE. The protein was further purified using Affinity chromatography and NylC protein was eluted with imidazole in the 0.3-3 molar.

Keywords: 6-aminohexanoate oligomer endo-hydrolase (NylC), *Agromyces* sp., Chaperone, *E. coli*, Nylon, Nylon hydrolase, Polyamide, Polymerization, Recombinant protein

Effects of Gamma Radiation on Growth and total phenolic compound in *Mentha canadensis*

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Canadian peppermint (*Mentha canadensis*) is a medicinal herb, which possesses a lot of bioactive components. Globally, it has been used as a food supplement. Due to the presence of phenolic acids and flavonoids, it is considered to have a greater number of antioxidants. Positive effects of mint are found in reducing blood sugar, analgesic property, cures loose motion, indigestion, and is good for breastfeeding. Therefore, this study focused on the effects of gamma radiation on the growth and biochemical compounds in Canadian peppermint. Sixty-day-old plantlets cultured *in vitro* were exposed to 0, 5, 10, and 15 Gy gamma ray at Nuclear Technology Research Center, Thailand. The results found that at dose of 10 Gy stimulated plant height and number of roots showing significant difference compared to control. However, gamma rays at doses of 0-15 Gy did not affect the number of leaves and branches. At dose of 5 Gy, gamma ray enhanced phenolic compound, chlorophyll a, chlorophyll b and carotenoid slightly increased significantly compared to non-irradiated control. Consequently, gamma ray is beneficial as abiotic elicitors in Canadian peppermint enhancing growth and total phenolic compound.

Keywords: Gamma ray, Canadian peppermint, phenolic compound, plant growth, *in vitro* culture

Enhancing Thermal Tolerance in Vetiver Grass via Gamma Irradiation-Induced Mutagenesis: A Strategic Approach for Adaptation to Rising Global Temperatures

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Climate change poses a critical threat to global ecosystems and agricultural productivity, necessitating the development of resilient plant varieties. This study explores the potential of gamma irradiation-induced mutagenesis to enhance the thermal tolerance of Vetiver Grass (*Chrysopogon zizanioides*), a species renowned for its environmental and agricultural benefits. Using a combination of morphological, physiological, and genetic analyses, we exposed Vetiver Grass to varying doses of gamma radiation, assessing the mutagenic effects on growth, physiological responses, and thermal tolerance. Our findings reveal a dose-dependent relationship, with low doses stimulating growth by up to 20% and higher doses inducing stress responses that potentially confer increased thermal tolerance of up to 5°C. Morphological adjustments, including reduced leaf width and alterations in root architecture, suggest adaptive strategies to mitigate heat stress. Moreover, the irradiation-induced genetic variability offers promising avenues for breeding thermally tolerant Vetiver Grass varieties by allowing for the selection of desirable traits and the development of improved varieties. This study underscores the efficacy of gamma irradiation-induced mutagenesis as a novel breeding strategy, contributing to the development of climate-resilient crops essential for sustaining agricultural productivity and ecosystem health in the face of escalating climate challenges and ensuring food security in a changing world.

Keywords: *Chrysopogon zizanioide* , Gamma irradiation-induced mutagenesis , heat tolerance

Effects of plasma-activated water on seed germination and growth of *Brassica rapa subsp. chinesis*

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Brassica rapa subsp. chinesis (Pak Choi) is a nutrient-rich leafy green vegetable that has gained popularity among consumers, leading to a rise in the demand for its production. Therefore, this study aimed to increase the germination and growth of Pak Choi using cold plasma technology. Plant nutrition (Hoagland solution) was treated with cold plasma generated from the plasma jet device using air gas at 1.5 Lpm for 0, 5, 10, and, 20 min. Plasma-activated Hoagland solution (PAH) was watered into the seed and the germination and growth were analyzed. The results showed that there was no significant difference in germination after exposure to PAH at different times when compared to the control (0 min). However, the growth of Pak Choi significantly increased after being watered PAH 10 min for 5 weeks by increasing the length, width, and biomass of the shoot and root and also increased chlorophyll content in the leaves of Pak Choi as compared to the control. These findings suggest that cold plasma technology can improve plant growth through the treatment of a solution. This will lead to the application of cold plasma technology for increasing agricultural production in the future.

Keywords: *Brassica rapa subp. chinesis*, Plasma-activated water, Cold plasma, Seed germination, Plant growth

Improving seed germination, growth, and salinity tolerance of *Oryza sativa* L. using cold plasma technology

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Jasmine rice 105 (*Oryza sativa* L.) is one of the most important staple foods for at least half the world's population. Currently, the impact of global warming is adversely affecting its growth, leading to a decline in rice production. Particularly, salinity stress plays a crucial role in diminishing the germination and growth efficiency of rice. Therefore, the objective of this study was to investigate the impact of cold plasma on promoting germination and growth, as well as enhancing salt tolerance in Jasmine rice 105. Rice seeds were treated with cold plasma using a micro-DBD plasma device, which utilized air gas at a rate of 1.5 Lpm for 0, 5, 10, and 20 minutes. Then, seed germination, and growth development in normal and salinity stress conditions (100 mM NaCl) were studied. The results indicated that cold plasma did not have any impact on seed germination when compared to the control (0 min). However, the growth was improved after treatment plasma for 20 minutes which significantly increased the shoot length and fresh biomass of shoot and root as compared to the control. In salinity stress conditions, seed germination did not show any significant difference when compared to the control while the shoot length and shoot biomass were significantly enhanced after treatment plasma for 10 and 20 minutes as compared to 0 min. This finding suggests that cold plasma technology could be used as an alternative method for improving the growth development and enhancing salinity stress tolerance of Jasmine rice 105.

Keywords: Cold plasma, Jasmine Rice 105, Seed germination, Growth development, Salt stress

Effects of plasma-activated water on seed germination and growth of *Brassica oleracea var. alboglabra*

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Chinese kale (*Brassica oleracea var. alboglabra*) is a highly nutritious plant that is popular for consumption. The cultivation of Chinese kale typically involves the use of chemical fertilizers to boost growth and increase yields. However, the presence of residues from these fertilizers in Chinese kale poses potential risks to both consumers and the environment. Therefore, the objective of this study was to enhance the germination and growth of Chinese kale by utilizing cold plasma technology, which is acknowledged as an eco-friendly technology. Distilled water was treated with cold plasma generated from a plasma jet device using air gas at 1.5 Lpm for 0, 5, 10, and 20 min and then watered into the seed. The seed germination, growth development, and alterations in pH levels were analyzed. The results showed that the level of DI water was slightly decreased following the increase in plasma treatment time. Plasma-activated water for 10 (PAW-10) and 20 min (PAW-20) significantly increased seed germination at 7 days as compared to the control (0 min). Moreover, the growth of Chinese kale was significantly enhanced after treatment PAW-5 min for 2 weeks by an increase in length and dry biomass of the shoot and root and chlorophyll content in the leaves when compared to the control. The results of this study demonstrate that Plasma-activated water is an alternative method to enhance the germination and growth of Chinese kale seeds which can be used to increase plant production in the future.

Keywords: Chinese kale, Cold plasma, seed germination, Growth development, plasma-activated water

Effect of plasma-activated water on seed germination and growth of *Ipomoea aquatica* Forsk *Var. rep tans*

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Ipomoea aquatica Forsk *Var. rep tans*, a nutritious green leafy vegetable, is highly favored by individuals for consumption. Nevertheless, most cultivation techniques involve the use of chemicals, leading to the presence of residues in the vegetables. Therefore, this study aims to increase the germination and growth of *Ipomoea aquatica* Forsk *Var. rep tans* using cold plasma technology recognized as a green technology. Distilled water was treated with plasma for 0, 5, 10, and 20 minutes and then applied to the seed. The seed germination, growth development, and alterations in pH levels were examined. The results showed that plasma-activated water for 10 minutes (PAW-10) significantly increased seed germination by around 10% as compared to the control (0 min). Moreover, the growth was improved after irrigating PAW-10 to seeds for 2 weeks which significantly increased the length and dry biomass of the shoot and root and chlorophyll content in the shoot when compared to the control. The pH level of DI water was slightly decreased following the plasma treatment time from 6.0 to 5.2. This finding demonstrates the potential of cold plasma technology in agricultural applications. It can enhance the germination and development of *Ipomoea aquatica* Forsk *Var. rep tans*, which will lead to a reduction in the use of chemicals in the future.

Keywords: *Ipomoea aquatica* Forsk *Var. rep tans*, Cold plasma, Plasma-activated water, Seed germination, Growth development

Effects of cold plasma on seed germination and growth of *Brassica oleracea var. albograbra*

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Brassica oleracea var. alboglabra, commonly known as Chinese kale, is a leafy green vegetable packed with nutrients that has seen a surge in popularity among consumers, leading to a higher demand for its cultivation. Hence, this research aimed to examine the influence of cold plasma on enhancing the germination and growth development of Chinese kale. Seeds were treated with cold plasma using a micro-DBD plasma device, which utilized air gas at a rate of 1.5 Lpm for 0, 30, 60, 120, and 240 seconds, and then seed germination and growth development were examined. The study revealed that subjecting Chinese kale seeds to cold plasma treatment for 60, 120, and 240 seconds led to a significant improvement in seed germination percentage. The most favorable outcome was observed after 120 seconds of plasma treatment, with around 46% of seeds germinating, in contrast to the control group where only 18% of seeds germinated. Nevertheless, the application of cold plasma did not result in any noticeable improvements in the growth of Chinese kale, as there were no significant differences observed in the length and biomass of the shoot and root, as well as the chlorophyll content in the shoot and leaves. The findings propose that the application of cold plasma technology holds promise in enhancing the germination of Chinese kale seeds. However, further investigations are warranted to improve its growth potential.

Keywords: Chinese Kale, Cold plasma, seed germination, Growth development

**Mutagenic effects of gamma radiation on Turmeric
under *in vitro* salt stress**

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Turmeric is considered as an economically important herbaceous plant that has many important substances due to its versatility in usage. Nonetheless, farmers still encounter challenges in cultivating turmeric repeatedly due to issues such as saline soil, due to during the last two decades the world has experienced sudden changes in climate. Soil salinity is one of the impacts of climate change in coastal agriculture land, dam construction, underground water seepage resulting in reduced productivity of turmeric. Therefore, this research aims to study mutagenic effects of gamma radiation on plant growth, stomata aperture area (SAA), and stomatal density (SD) under *in vitro* salt stress. Turmeric cultured *in vitro* exposed to 40 Gy gamma ray and sub-cultured to M_1V_5 generation in previous studied were used in this experiment. Sixty-day-olds plantlets were sub-cultured in MS media supplement with 0 and10 of NaCl. Plant height, leaves number, roots number, leaves areas, stomata aperture area (SAA), and stomatal density (SD) were observed. The results found that the wild type plants (non-irradiated population) cultured in MS media supplement with 10 mM of NaCl revealed significant differences in roots number compared to control (0 mM of NaCl). According to these results we isolated 11 plants from gamma ray irradiated population. Comparative effects of 0 and 10 mM of NaCl in wild type and irradiated plants demonstrated that all 11 isolated plants showed greatly in stomatal density (SD) and two of them revealed highly in stomata aperture area (SAA).

Keywords: *Curcuma longa* L., *in vitro* selection, Salt stress, Stomata Anatomical Traits

Gamma-ray radiochromic dosimeter from *Brassica oleracea var. capitata f. rubra*

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Radiochomic dosimetry is a radiation measuring technique based on the modifying the structural characteristics of sensitive molecules when exposed to ionizing radiation. The changing active compounds lead to changing color of the samples that can be observed by naked eyes or photo spectroscopic instruments. In this project, we focus attention on plant extraction radiochromic dosimeters. The objective was to study the capability of extracted solutions from purple cabbage or *Brassica oleracea var. capitata f. rubra*. The deep blue solutions were prepared from the cabbage leaves by soaking 10 grams in 100 ml ~40 degrees Celsius for 24 hours and was collected in ampoules. The sample solutions were irradiated by the Gr420 gamma irradiator with 0, 5, 10, 15, and 20 kGy. The irradiated solutions were measured absorbance by a UV-Vis spectrophotometer. The highest absorbed peak was 543 nm. The results showed that the color of irradiated solutions faded from deep blue to lighter blue as a function of radiation absorbed dose. The extracted solution from purple cabbage could be used as a radiochromic dosimeter for detecting gamma rays, with the color changing based on the dose of radiation absorbed.

Keywords: Radiochromic, Dosimetry, UV-Spectrophotometer

Antioxidant and Radioprotective properties of Proanthocyanidins from grape seed extract

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Free radicals can be generated by various endogenous systems in the human body. They can damage cells and their mechanisms have been implicated in the pathology of several diseases such as cancer, atherosclerosis, rheumatoid arthritis, neurodegenerative, cardiovascular, and inflammatory diseases. A balance between free radicals and antioxidants can lead to various diseases. Recently, there has been increasing interest in the prevention of disease mediated by free radicals. Grape seed extract, well known antioxidant, is one of the most popular dietary supplements which helps to protect against oxidative stress by preventing the formation of radicals and scavenging oxygen from radiation. The objective of this study was to study the antioxidant properties and radioprotective effect of Proanthocyanidins from grape extract. In this study, antioxidant activity was analyzed by using DPPH and ABTS assay. total phenolic content (TPC) was measured in the amount of total phenolic compounds using the Folin-Ciocalteu method. The results showed that the TPC of Proanthocyanidins was 4.65 ± 0.04 mg GAE/g of sample, the EC50 of Proanthocyanidins were 104.14 ± 15.87 µg/ml and 123.79 ± 14.90 µg/ml using DPPH and ABTS assay, respectively. Radioprotective effects were studied on Dermal fibroblast cells by using MTT assay. It was found that Proanthocyanidins can reduce the damage caused by radiation. Therefore, Proanthocyanidins exhibit antioxidant properties and radioprotective effects in cell line.

Keywords: Proanthocyanidins, Antioxidant properties, Radioprotective effect.

Exploring the Distribution and Phytoremediation of Heavy metals by *Chrysopogon zizanioides* in Contaminated Soils using Micro-XRF Analysis

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The rapid industrialization and urbanization of the past century have led to an alarming increase in environmental pollution, particularly the contamination of soil and water resources by heavy metals such as cobalt (Co) and copper (Cu). Although these metals are essential micronutrients for plant growth at low concentrations, excessive levels can cause severe toxicity. This study investigated the phytoremediation potential of vetiver grass (*Chrysopogon zizanioides*) for Co and Cu-contaminated soils using micro-X-ray fluorescence (μ-XRF) spectroscopy. Vetiver grass plants were exposed to varying concentrations (50, 100, 150, 200 ppm) of Co and Cu for 7 days under soil conditions. Micro-XRF revealed distinct time-dependent and concentration-dependent responses in metal uptake, translocation, and accumulation within the plant tissues. Initially, Co and Cu predominantly accumulated in the root system and lower stems. After 5 days, significant translocation to the upper stems and leaves occurred, especially at higher metal concentrations. By the end of the 7 days, extensive distribution of Co and Cu was observed throughout the entire plant, The μ-XRF imaging provided compelling visual evidence of metal mobilization from roots to shoots, highlighting vetiver grass's efficacy for phytoremediation of Co and Cu-contaminated environments. The spatial resolution offered insights into metal uptake mechanisms, informing optimization strategies to enhance phytoextraction efficiency. This investigation affirms vetiver grass's phytoremediation potential and underscores the value of μ-XRF in elucidating plant-based remediation processes for the sustainable management of heavy metal pollution. These findings contribute to developing effective phytoremediation strategies using vetiver grass, offering a promising solution for the remediation of Co and Cu-contaminated soils.

Keywords: Vetiver grass, Micro-XRF, Phytoremediation, Cobalt, Copper

Radioactivity detection efficiency calibration of 4π ionization chamber using Co-60 and I-131

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The activity measurement of radionuclide using a 4π (re-entrant) ionization chamber is a globally recognized technique for metrology and measuring the amount of radiation in various fields, especially nuclear medicine. The well-type 4π ionization detector is based on the principle of being hermetically sealed and contains a gas at high pressure (typically 1 MPa of nitrogen). When the device is exposed to radiation, an interaction of the gas inside the detector chamber leads to generate ion pairs in the chamber. In the sensitive volume, these ions are accelerated by 400-volt high voltage to create electrical currents. The project aims to determine the efficiency and optimal position of the 4π ionization chamber detector using the standard radiation sources holmium-166m, cobalt-60, and iodine-131. The standard radiation sources of holmium-166m and cobalt-60 were measured by the 4π ionization chamber at the well depth of 0, 0.4, 1.4, 2.4, 3.4, 4.4, 5.4, 6.4, 8.4, 10.4, 12.4, 14.4, 16.4, 18.4, 20.4, 22.4 and 24.4 centimeters from a referent position. Data was collected in the form of electrical currents at each position to analyze the differences between distances and positions. Additionally, the detector was used to determine activity of I-131 solutions, which were compared to theoretical decay values from LNE-LNHB (France) at the Office of Atoms for Peace (OAP), to correct decay time during the measurement. Lastly, to develop the measurement process of the 4π ionization chamber for more versatile operations, a standard iodine-131 radiation source in glass ampoule was measured with the 4π ionization chamber to collect data in the form of electrical current. The iodine-131 solutions were transferred to glass vial. The electrical currents were collected to compare standard radiation sources that have equal volumes and determine the vial geometry correction factor. The results showed that the optimal measurement position for the 4π ionization chamber detector for Ho-166m, Co-60, and I-131 was 6.4 cm, 4.4 cm and 6.4 cm respectively. The radiation sources exhibited a half-life consistent with theoretical values. The standard deviation was ……..%. Additionally, the measurement geometry correction factor was 0.999686. Finally, the acquired values could be improved by a 4π ionization chamber.

Keywords: 4π ionization chamber, Current measurement, Cobalt-60, Iodine-131c

Antioxidant Activity and Radioprotective Effect of *Trans*-Resveratrol

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Trans-Resveratrol, one of the most popular phytoalexins, is a polyphenol which naturally occurs in grapes and red wine. It has beneficial effects on the human body, especially on the cardiovascular system. It possesses several biological activities such as anti-inflammatory, anti-tumorigenic, antioxidant, antiviral, antibacterial and antifungal properties. In addition, it may have therapeutic effects against various types of cancer. Ionizing radiation can damage the cells, affect human health, and causes many diseases in humans. Exposure to high levels of radiation can cause acute health effects such as skin burns and acute radiation syndrome. There is a need to protect against the effects of ionizing radiation. In this study, total phenolic content (TPC), antioxidant activity and radioprotective effect of *trans*-resveratrol were investigated. The results showed that the TPC of *trans*-resveratrol was 50.50 ± 0.02 mg GAE/g of sample, the EC50 of *trans*-resveratrol were 32.06 ± 0.96 µg/ml and 5.04 ± 0.35 µg/ml using DPPH and ABTS assay, respectively. The radioprotective effect on human dermal fibroblast cell line using MTT assay found that *trans*-resveratrol could protect against gamma irradiation at the dose of 0,10,20, and 40 Gy. In conclusion, *trans*-resveratrol can be used as an antioxidant to protect against radiation by preventing the death of human dermal fibroblast cell line.

Keywords: *Trans*-Resveratrol, Antioxidant, Radioprotective, Total Phenolic Content

Antioxidant activity and Radioprotective effect
of N-Acetylcysteine (NAC)

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N-Acetyicysteine (NAC) has been widely used to treat acetaminophen overdose and act as mucolytic agent in respiratory disease. It has antioxidant and anti-inflammatory activity which ahs been used to treat several diseasesrelated to oxidative stress and inflammation.

The objective of the study was to examine antioxidant activity using DPPH and ABTS assay, measure total phenolic content (TPC) using Folin-Ciocalteu method and study the radioprotective effect using MTT assay. The results showed that EC_{50} values of NAC was 304.90 ± 17.75 µg/ml and 14.98 ± 0.66 µg/ml using DPPH and ABTS assay respectively. The TPC of NAC was 2.467 ± 0.13 mg GAE/g of sample. In addition, NAC at the dose of 10 and 20 µg/ml, was not cytotoxic on human dermal fibroblast cell line. The radioprotective effect showed that NAC could protect against gamma irradiation at the dose of 0, 10, 20 and 40 Gy. Therefore, NAC exhibited antioxidant activity to scarenge free radicals and protect gamma ray irradiation in cell line.

Keywords: N-Acetylcysteine , Antioxidant properties, Radioprotective effect

Effects of gamma irradiation on growth and pigments of *Pinguicula* sp. *in vitro* culture

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Pinguicula sp. is an insectivorous plant distributed almost worldwide, specifically in Mexico and Europe. Pinguicula was cultivated and traded as an ornamental plant due to its exquisite appearance, leaf and flower colors, and beautiful canopy, making it highly sought after in the market. Consequently, these exotic characteristics play a crucial role in the ornamental plant market. The objective of this experiment was to investigate the effects of acute gamma radiation on growth and pigments of pinguicula under sterile conditions. Sixty-day-old plantlets cultured *in vitro* were exposed to 0, 20, 40, 60, 80, and 100 Gy gamma ray at Nuclear Technology Research Center, Thailand. The results found that the number of new seedlings and leaves decreased when radiation doses increased, and dramatically significant difference compared to non-irradiated control. A radiation dose resulting in a 50% growth reduction ($GR_{50(56)}$) was determined by the number of new seedlings and leaves revealed 30 Gy and 27 Gy, respectively. On the other hand, at the doses 0-100 Gay gamma ray did not affect survival percentage of pinguicula. Furthermore, changes in leaf color were observed at 20 Gy gamma ray with purple leaves margin and variegated leaves characteristics which affected chlorophyll a, chlorophyll b and carotenoid contents. Thus, Gamma irradiation combining with tissue culture techniques could contribute to induced mutation in Pinguicula.

Keywords: *Pinguicula* sp, Gamma irradiation, Pigment content, tissue culture

Quantitative analysis of tritium radioactivity in marine fishes

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The accident at Fukushima Daiichi Nuclear Power Station (FDNPS) in March 2011 and the subsequent operations at the plant have resulted in the accumulation of large amounts of water stored on the site. In August 2023, it decided to discharge it gradually into the Pacific Ocean after specific treatment. Contaminated water stored on site is treated to remove most of the radioactive content, except for tritium, which cannot be removed by the Advanced Liquid Processing System (ALPS). Tritium is a radioactive hydrogen isotope with one proton and 2 neutrons. Tritium has half-life 12.32 years and decays to 3He emission of a low-energy beta particle. Some of the tritium released into the environment can get into nutrients such as carbohydrates, fats, or proteins. Tritium in biological samples consists of tissue-free water tritium (TFWT) and organically bound tritium (OBT). TFWT is defined as tritium in water that is not bound to tissue molecules. Tritium consumed in food (organically bound tritium) poses a slightly greater health risk, as the body retains it longer than tritiated water. This means the tritium atom is more likely to decay while in the body, possibly damaging cells. This research therefore to determine the tritium content in marine fishes 10 samples by liquid scintillation counting of tissue-free water tritium obtainable by reduced pressure distillation of a sample composite to estimate damage from radiation exposure to marine fishes. Most of the tritium levels were below the Minimum Detectable Concentration (MDC, typically 1.6-3.0 Bq kg-1) and Limit of Quantitation (LOQ, typically 7.9-15 Bq kg-1). However, the tritium content would not pose any harm to the fish population.

Keywords: Tissue free-water tritium, Marine fish, Environment, Fukushima Daiichi Nuclear Power Station

Effects of Gamma Radiation on the Antioxidant Properties of Longan Honey, Snakeroot Honey and Lychee Honey

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Honey, a natural product renowned for its high nutritional and medicinal value, has long been utilized in traditional Thai medicine for its disease prevention properties. Its therapeutic efficacy is attributed to its remarkable antioxidant capacity. Gamma irradiation has emerged as a safe and effective method, demonstrating its ability to enhance quality and nutritional content. This research aims to study the effects of gamma radiation on the antioxidant activities of three types of honey: longan flower honey, snakeroot honey, and lychee honey. The honey samples were subjected to different doses of Co-60 gamma radiation (5, 10, and 20 kGy), and their antioxidant activities were examined using the DPPH Assay. The results revealed that snakeroot honey exhibited the highest antioxidant activity, followed by longan flower honey and lychee honey, respectively. Surprisingly, the antioxidant activities of the three types of honey irradiated with 5, 10, and 20 kGy did not significantly differ compared to the control group. These findings suggest that radiation doses in the range of 5-20 kGy had no effect on changing the antioxidant activity of honey. This is particularly noteworthy as it opens avenues for further research in the area of food preservation using radiation without compromising the nutritional value of honey. Such insights will undoubtedly contribute to making the use of honey more efficient and sustainable in the future.

Keywords: Honey, Longan flower, Snakeroot flower, Lychee flower, Gamma rays, Antioxidant

Silver nanoparticle synthesis using gamma ray irradiation to quantitative analysis of aflatoxin B1

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The project focused on synthesis silver nanoparticles (AgNP) using gamma irradiation for measuring of aflatoxin B1 (AFB1) content. The objectives of this work was to prepare silver nanoparticles and to determine of aflatoxin B1 content extracted from ground peanuts. The nanoparticle synthesis process involved using polyvinyl alcohol (PVA) and sodium tri-citrate as stabilizers. The mixture solutions were irradiated gamma irradiation with an absorbed dose of 5.0 kGy, resulting in a maximum absorbed peak at 436 nm, showing the formation of silver-nanoparticles. The quantitative analysis of aflatoxin B1 was conducted using a colorimetric technique, resulting from reaction between AgNP and AFB1 in different the ratio. The results showed that the amount of aflatoxin B1 extracted corresponded with absorbance AgNP with linear regression 0.9766 and absorbance AgNP add PBS with linear regression 0.9589. This technique can be developed and used as an alternative technique of quantifying the concentration of aflatoxin B1.

Keywords: aflatoxin B1, silver nanoparticles, Gamma radiation

Antioxidant activity and radioprotective effect of Dihydromyricetin

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Dihydromyricetin, also known as ampelopsin, is a flavonoid isolated from *Ampelopsis grossedentata*, which is traditionally used in the south of China. It has been known to exhibit several biological effects such as antioxidative, anti-inflammatory, anticancer, and antimicrobial activities. It may protect against oxidative stress by scavenging reactive oxygen species. Radiations, for example gamma, alpha and beta rays, can affect the human body in many routes of exposure and cause ionizations which damage tissue and DNA. The adverse health effects may range from mild to severe effects such as cancer and death, depending on the dosage and type of radiation. In this study, total phenolic content (TPC), antioxidant activity and radioprotective effect of Dihydromyricetin were investigated. The results showed that the TPC of Dihydromyricetin was 38.17 ± 0.01 mg GAE/g of sample, the EC50 of Dihydromyricetin were 256.90 ± 2.47 µg/ml and 128.94 ± 1.22 µg/ml using DPPH and ABTS assay, respectively. The radioprotective effect on human dermal fibroblast cell line using MTT assay showed that Dihydromyricetin could protect against gamma irradiation at the dose of 0,20, and 40 Gy. It concluded that Dihydromyricetin contained phenolic compounds which can be used as antioxidants to scavenge free radicals and protect gamma ray irradiation.

Keywords: antioxidant, Dihydromyricetin, free radicals, radioprotective

Analysis of antioxidant activity and radioprotective effect of Urolithin A

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Urolithin A is a substance that results from the transformation of ellagitannins by bacteria in the intestines It belongs to a group of organic compounds called benzo coumarins or dibenzo-alpha-pyrones. by ellagic acid and ellagitannins It is everywhere in nature. These include edible plants such as pomegranates, strawberries, raspberries and walnuts, which are known for their antioxidant and anti-inflammatory properties. This has led to the increasing popularity of urolithin A dietary supplements. In the past few years Therefore, the antioxidant properties of urolithin A were studied by the DPPH assay and ABTS assay, including the measurement of total phenolic compounds (TPC assay) by the Folin-ciocalteu reagent method. From the experiment, it was found that urolithin A showed activity. The highest antioxidant activity in the DPPH and ABTS assay (EC_{50} values were 84.03 ± 5.76 and 32.75 ± 10.54) and from the analysis of total phenolic content, it was found that urolithin A had a phenolic compound value of 62.80 ± 0.01 mg GAE /g. extract and studied the effect of radiation protection on inhibiting Dermal Fibroblast cells using MTT assay. It was shown that cells treated with urolithin A were able to protect against gamma T radiation with doses of 0, 10, 20 and 40 Gy. that urolithin A is a phenolic compound That can be used as an antioxidant to protect against free radicals and can be used to protect against gamma rays.

Keywords: Antioxidant, Urolithin A, Free radicals, Radioprotective effect

Study of bacteriophages-mediated elimination of *Klebsiella pneumoniae*

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Bacteriophage or phage is a virus that uses host-specific bacteria to replicate. Bacteriophages are highly specific to host bacteria. *Klebsiella pneumoniae* is one of the medically important bacteria due to its multidrug resistance. The objective of this study was to select bacteriophages that are effective in eliminating different capsule types of *K. pneumoniae*. A total of 28 bacteriophage isolates were tested against 29 isolates of *K. pneumoniae* with different KL types. Host range test showed that bacteriophage c001BB_02, isolated using *K. pneumoniae* C001 (KL type 64), was able to eliminate most of *K. pneumoniae* isolates that have KL type 64, and it was the only isolate that was able to eliminate *K. pneumoniae* C013, which is KL type 19. Therefore bacteriophage c001BB_02 was chosen for further experiments. Efficiencies of the plaquing test (EOP) of bacteriophages c001BB_02 with *K. pneumoniae* C013 had an EOP value of 0.000875 or was interpreted as ineffective. A multiplicity of infection (MOI) assay of bacteriophage c001BB_02 with *K. pneumoniae* C001, C013, C029 and C071 was carried. Results showed that at MOI 1, 0.1, 0.01, and 0.001, bacteriophage c001BB_02 was able to inhibit the replication of *K. pneumoniae* during the first 2–4 hours. After 4 hours, it was found that the presence of bacteriophage resulted in an increasing number of bacteria. Inhibition of biofilm by bacteriophage c001BB_02 with *K. pneumoniae* C001, C013, C029 and C071 resulted in the decreased relative availability of biofilm when bacteriophage concentrations were increased. In addition, bacteriophage c010BB_01 can eliminate numerous *K. pneumoniae*, up to 9 isolates. Further, bacteriophages c009KL1_01, C063e and c063_CT_002 were able to inhibit *K. pneumoniae* of up to 3 KL types. In summary, bacteriophage c001BB_02 was not effective in inhibiting *K. pneumoniae* isolates other than those having KL type 64. The efficiency of c001BB_02 in eliminating *K. pneumoniae* C029 and C071 was lower than that of the C001. In contrast to the biofilm inhibition property of c001BB_02, it was shown ineffective in the inhibition of planktonic *K. pneumoniae* cells.

Keywords: Bacteriophage, *Klebsiella pneumoniae*, Multidrug resistance bacteria, Biofilm

Effects of the extracts from *Ganoderma* mushroom cultivated on different substrates on pathogenic bacteria

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Ganoderma lucidum, known as the Lingzhi mushroom in Chinese traditional medicine, has long been used for health enhancement, prevention, and treatment of diseases. This study aimed to evaluate the antibacterial activity of an ethanolic extract from *Ganoderma lucidum* cultivated on different substrates against *Staphylococcus aureus* ATCC 25922. The substrates included T100 (100% durian sawdust), P50 (50% durian sawdust, 50% rubber sawdust), P100 (100% rubber sawdust) and GC (commercial *G. lucidum*). Screening of the antibacterial activity of all four extracts was performed using the disc diffusion method with concentrations of 10-20 mg /disk. As a result, the T100, T50, P100, and GC extracts showed inhibitory effects against the tested bacteria in disks impregnated with 20, 18, 18, and 20 mg/disk. The diameters of the clear zones were 7.5, 7, 7, and 8.5 mg/disk, respectively. The minimum inhibitory concentration (MIC) of *G. lucidum* extracts was determined using the broth microdilution method. The results found that the *G. lucidum* extracts, including T100, T50, P100 and GC, exhibited inhibitory effects against the tested bacteria with MIC values of 2.5, 10, 5 and 5 mg/mL, respectively. Additionally, the minimum bactericidal concentrations (MBC) of the T100, T50, P100, and GC extracts against the tested bacteria were greater than 10 mg/mL.

Keywords: *Staphylococcus / Ganoderma* extract / Antibacterial activity

Study on the effect of Brazilian Pepper Leaves extractson HPV inhibition in HeLa and CaSki cervical cancer cell cultures

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Schinus terebinthifolius is an herbal plant that is taken as food. Fresh leaves of *S. terebinthifolius* inhibited various cancers. However, the effect of *S. terebinthifolius* extract has not been reported against cervical cancer. This study aims to investigate the effect of *S. terebinthifolius* extract from fresh and dried leaves on human papillomavirus type 16 (HPV16) positive cervical cancer cell lines CaSki and HeLa. Extracts were provided using water-based extraction in room temperature and 100°C for 30 minutes, and then the extracts which were aliquot were dried using freeze-drying process. The extracts were tested for anti-cervical cancer and anti-HPV16-pseudovirus infection using MTT assay, acridinine orange/ethidium bromide (AO/EB) dual staining, caspase 3 assay, real-time polymerase chain reaction (RT-PCR) and western blot, and binding assay, respectively   The bioactive compound including protein, polysaccharide, and total phenolic compound were measured using colorimetric assay. From the results, freeze-dried extracts from fresh leave extracted in room temperature and 100 °C had higher efficient inhibited growth of cervical cancer cells higher than dried. Simultaneously, dried extract at 100°C at 0.5 mg/ml completely inhibited HPV16-pseudovirus infection. The possible mechanism of these extracts that can inhibit growth of CaSki and HeLa is the p53 upregulation resulting in apoptosis induction.

Keywords: *Schinus terebinthifolius*, human papillomavirus, cervical cancer

Study on the effect of *Astraeus hygrometricus* extracts on HPV inhibition in HeLa and CaSki cervical cancer cell cultures to develop a prototype of healthcare

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Astraeus hygrometricus is a wild mushroom that can be found in some region of Thailand. It is very popular to consume by cooking in hot water in local region. There are many reports of *A. hygrometricus* extracts on anti-cancers including human papillomavirus (HPV)-associated cancer. However, there is no report its application on anti-HPV and cervical cancer. This study aims to investigate the effect of dried *A. hygrometricus* stored in room temperature (25-35°C) for 1 and 3 mounts and then extracted using water-based extraction in 100°C. Some water extracts were dried using freeze-drying process. The cytotoxic concentration and apoptosis of the extracts treated CaSki and HeLa using MTT, and acridine/ethidium orange (AO/EB) staining and caspase 3 assay respectively. Anti-HPV16 pseudovirus infection was evaluated using binding assay. The p53 tumor suppresser protein, and *BCL2*, *BAK* and HPV16E6 genes were investigated by western blot, and real time polymerase chain reaction, respectively. From the result, the extracts that were derived from freeze-drying process did not effect on CaSki and HeLa cytotoxicity whereas the extract from water without freeze-drying process showed higher cytotoxicity particularly the extract form 1 mount (W1-extract). In addition, only W1-extract significantly inhibited HPV16-pseudovirus infection. The molecular mechanism of these extracts can upregulate p53 protein and *BAK* while *BCL2* was downregulated. Even though the population of apoptosis was not increased in treated cells, caspase 3 activity was higher than control (DMSO). From these results, we demonstrate that the extract from freeze-drying process is not suitable for medical *A. hygrometricus* application while the extracts in water without freeze-drying process that storage for 1 mount shows highest efficient inhibited growth of CaSki and HeLa as well as HPV16 infection in contrast to 3 mounts.

Keywords: *Astraeus hygrometricus*, human papillomavirus, cervical cancer

Effects of γ-ray irradiation on the functional groups of collagen hydrolysate from chicken feet

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Collagen is a protein mainly content in animal connective tissues, composing approximately 30 % of total protein in animals. The digestion of the protein can be carried out with enzyme or chemical processes. However, these techniques are expensive and difficult to control the processes. Radiation process is an alternative technique, offering a clean, additive-free, and simple method for preparation the biopolymer. The initial effects of ionizing radiation are based on excitation and ionization process to the natural protein, leading to the formation of radical and molecular species, which then causes the collagen molecule degradation. The project is focused on studying the effect of gamma irradiation on functional groups of collagen hydrolysate molecules from chicken feet. Collagen from poultry sources is an alternative source and a common by-product from the industry. In this study, hydrolyzed collagen from chicken feet extracted by ethanol was investigated. Gamma irradiation was performed with absorbed doses of 0, 5, 10, 15 and 20 kGy using a gamma irradiator. The absorbed dose was performed by the standard Fricke dosimeter. The functional groups were analyzed by Fourier transform infrared spectroscopy (FTIR). The results showed a spectrum with five significant peaks representing functional groups of collagens, namely amide B, amide I, amide II, amide III and CH_3. The absorption peaks of the functional groups change due to gamma irradiation as a function of radiation doses. The absorption peak of amide I appear the highest peak. Since it is related to the stretching vibration of the carbonyl group (C=O), irradiation of collagen causes damage to the covalent bonds. The higher absorbed dose, the more damage and the more carbonyl groups are formed. The gamma irradiation techniques could be used to damage the collagen protein structures without using any enzymes or chemicals.

Keywords: collagen irradiation, gamma irradiation, collagen hydrolysate

Probiotic properties of lactic acid bacteria isolated from edible insects

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This study explored the potential probiotic properties of lactic acid bacteria (LAB) isolated from the gut microbiota of commercially relevant edible insects. Thirty-two LAB isolates were obtained from guts of mealworms (*Tenebrio molitor*: Tm), superworms (*Zophobas morio*: Zm), two-spotted crickets (*Gryllus bimaculatus*: Gb), and house crickets (*Acheta domestica*: Ad). Thirteen isolates were selected based on different pattern profiles of the Amplified Ribosomal DNA Restriction Analysis (ARDRA) and the analysis of 16S rRNA gene sequence showed that, the selected isolates were related to *Pediococcus pentosaceus*, *Enterococcus faecalis*, *Lactiplantibacillus pentosus*, *Lactococcus garvieae*, *Enterococcus thailandicus*, *Enterococcus raffinosus*, *Weissella confusa,* and *Enterococcus* sp. The isolate *L. pentosus* Gb06 from *G. bimaculatus* emerged as the most promising candidate. Gb06 demonstrated potent antagonistic activity against foodborne pathogens (*Bacillus cereus* ATCC 11778, *Escherichia coli* ATCC 8739, and *Staphylococcus aureus* ATCC 6538) through its cell-free supernatant. Moreover, Gb06 exhibited tolerance to both acidity and bile salts suggesting its potential for survival in gastrointestinal tract; showed α-hemolytic activity and antibiotic susceptibility indicating its safety for potential applications. Additionally, high hydrophobicity and auto-aggregation suggested its ability for effective intestinal colonization. Co-aggregation assay revealed strong adherence (51.77%) of Gb06 against the pathogenic bacteria *B. cereus* ATCC 11778. Notably, Gb06 demonstrated a high adhesion rate (74.75%) to human colon adenocarcinoma HT-29 cells. These findings provide a knowledge and compelling LAB candidates for future applications to improve growth, health, and food safety of edible insects.

Keywords: Edible insect, Gut microbiota, Lactic acid bacteria, Probiotic

Study on antimicrobial activity of *Hericium erinaceus* extract against pathogenic microorganisms and human colon adenocarcinoma cell

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Hericium erinaceus also known as Monkey's head mushroom is an edible mushroom and has high medicinal properties used in traditional Chinese medicine with a centuries-old to treat gastrointestinal disease. The purpose of this study was to extract bioactive compounds from Monkey's head mushrooms and to evaluate the antimicrobial activity against pathogenic microorganisms and human colon adenocarcinoma (Caco-2 cell). Bioactive compounds were extracted from Monkey's head mushrooms by 2 solvents; water and ethanol. For the antimicrobial assay, five species pathogenic microorganisms including *Listeria monocytogenes, Enterococcus faecalis, Escherichia coli, Salmonella* Typhimurium and *Aspergillus flavus* were analyzed. The result showed that the water and ethanol extraction can against all of the pathogenic microorganisms, the lowest concentration was 0.5 g/mL. In the part of against Caco-2 cell using 3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide (MTT assay). The result showed that the water and ethanol extract can against Caco-2 cell, the lowest concentration was 500 and 31.25 µg/mL, respectively. From the results, both extracts have an antimicrobial activity against pathogenic microorganisms and human colon adenocarcinoma.

Keywords: *Hericium erinaceus*, Ethanol extract, Water extract, Antimicrobial activity, Caco-2 cell

Chitinase-producing *Paenibacillus* spp. and their effect against common cutworm (*Spodoptera litura*) as a biopesticide

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The common cutworms, *Spodoptera litura,* are moth larvae that infest most economic crops and cause damage to plants. To reduce harmful effects of chemical pesticides, potential bacteria and their enzymes are considered biocontrol agents. The objectives of this study were to test a mortality ability of chitinolytic bacteria and their chitinase against the common cutworms. In this study, seven isolates of chitinolytic bacteria derived from guts of termite *Termes comis* were tested. The highest chitinase production, biofilm formation, and insecticidal activity were found in *Paenibacillus riograndensis* TC·HS26 and this isolate was used for subsequent experiments. The isolate TC·HS26 exhibited the highest chitinase activity (0.45 ± 0.06 U/ml) at 96 h of cultivation and its concentrated chitinase showed high insecticidal activity with the lethal concentration 50 (LC_{50}) value of 343.80 ± 10.43 mU/ml within 48 h. Moreover, host plant leaves (chinese kale) treated with the chitinolytic bacteria and concentrated bacterial chitinase could enhance the larval mortality of common cutworms. This study may serve as a model for studying the bioinsecticides in the future.

Keywords: *Paenibacillus* sp., Termite gut, Chitinase, Common cutworm, Bioinsecticide

Effects of the extracts of *Ganoderma* mushroom cultivated on different substrates on gastrointestinal pathogenic bacteria

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This study evaluated the antibacterial activity of extracts from *Ganoderma* spp. cultivated on different substrates (durian and rubber sawdust in a 50:50 (T50), 100:0 (T100), and 0:100 (P100) w/w ratios) against gastrointestinal pathogens. The dried *Ganoderma* spp. powder was extracted with ethanol and then screened for antibacterial activity against five bacteria (gram-positive: *Enterococcus faecium* and *Enterococcus faecalis*; gram-negative: *Escherichia coli*, *Salmonella enterica* serovar Typhimurium, and *Shigella boydii*) using the disc diffusion method. The results showed that, a concentration of at least 14 mg/disc, the extracts from T50, T100, and P100 inhibited three bacterial species (*E. faecium*, *E. faecalis*, and *S. boydii*) while the commercial *Ganoderma* spp. extract (GC) inhibited all five bacterial species. Next, the minimum inhibitory concentration (MIC) was determined by the broth dilution method. Extracts from T50, T100, and P100 inhibited *E. faecium*, *E. faecalis*, and *S. boydii* with MIC values of 1.25, 1.25, and 10 mg/ml (T50), 10, 1.25, and 1.25 mg/ml (T100), and 5, 2.5, and 2.5 mg/ml (P100), respectively. The GC extract inhibited *E. faecium*, *E. faecalis*, *S. typhimurium*, and *S. boydii* with MIC values of 2.5, 5, 10, and 10 mg/ml, respectively. The minimum bactericidal concentration (MBC) of all extracts against all tested bacteria was more than 10 mg/ml.

Keywords: Gastrointestinal pathogenic bacteria, *Ganoderma* spp., Antibacterial activity

Melliferous plants and Palynological analysis of wild honey in Patio District, Chumphon Province

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Honey is a natural product from honeybee which it has a high minerals and nutrition. Honey has a high diversity of plant pollen that bees collected gathering with nectar. That may cause allergy in humans from its allergic effect, so that is how the plant pollen identification begins. The purpose of this study is to identification the melliferous plants using pollen morphology for qualification control and protect the consumers from allergic and poisonous plants. The melliferous plants and wild honey were collected from Patio District, Chumphon province. The plant surrounded the hive not more than 3 km were collected. Plant samples were identified and the voucher specimens were prepared. The pollen from plants and honey were prepared for pollen morphological analysis using acetolysis techniques. The results showed that it can be identified to species up to 49% and 51% is unknown. 71% of known species are wild plants as: *Acacia mangium* Willd. (Fabaceae), *Acronychia pedunculata* (L.) Miq. (Rutaceae), *Bidens pilosa* L. (Asteraceae), *Bruguiera gymnorrhiza* (L.) Lam. ex Savigny. (Rhizophoraceae), *Dianella ensifolia* L. (Xanthorrhoeaceae), *Eugenia javanica* Lank. (Myrtaceae), *Flagellaria indica* L. (Flagellariaceae), *Leucaena leucocephala* (Lam.) de Wit. (Fabaceae), *Memecylon plebejum* Kurz. (Melastomaceae), *Micocos tomentosa* Sm. (Malvace), *Mimosa pudica* L. (Fabaceae), *Pluchea indica* (L.) Less. (Asteraceae), *Rhodomyrtus tomentosa* (Aiton) Hassk. (Myrtaceae), *Richardia brasiliensis* Gomes. (Rubiaceae), *Ruellia tuberosa* L. (Acantaceae), *Syzygium antisepticum* (Blume) Merr. & L.M.Perry. (Myrtaceae), *Syzygium grande* (Wight) Walp. (Myrtaceae), *Vitex limonifolia* Wall. ex C.B.Clarke. (Lamiaceae), *Vitex negundo* L. (Lamiaceae), *Waltheria indica* L. (Malvaceae) 22.5% is economic plants as *Cocos nucifera* L. (Arecaceae), *Elaeis guineensis* Jacq. (Arecaceae). 6.3% is medicinal plants as *Casuarina equisetifolia* L. (Casuarinaceae), *Tetraceara loureirin* Finet & Gagnep.) Pierre ex Craib (Dilleniaceae), *Trema orientalis* (L.) Blume (Cannabaceae). Basing on pollen analysis, they have no allergic and poisonous plants which it is safe for consumer and quarantine the wild honey. The melliferous plants can be served pollen all year-rounded for bee it makes bees stay in their hive. This data supported beekeeper for management the melliferous plants such as grown the melliferous plants or protect the melliferous plant in natural sources.

Keywords: *Apis cerana,* Multiflora honey, Southern Thailand

Effectiveness of Thai herbal extracts on normal and antibiotic- resistant *Cutibacterium acnes*

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Abstract

Antimicrobial resistance (AMR) is one of the most urgent health problems facing the world nowadays. Though non-fatal, acne vulgaris is a common skin condition originating from *Cutibacterium acnes* (*C. acnes*) infection, leading to mental health issues of low self-esteem and anxiety. Antibiotic resistance in *C. acnes* has been reported in many countries around the world for over two decades. AMR has emerged in *C. acnes*, leading to the need for new treatments. Thai herbal plants are cultivated primarily for industrial or medicinal purposes. Eight Thai herbal extracts were examined as a new potential antibiotic against antibiotic-sensitive (JB7 and JB13) and resistant isolates of *C. acnes* (JB51) using Minimum inhibitory concentrations (MICs) and Minimum bactericidal concentrations (MBCs). The results demonstrated that all extracts exhibited inhibitory activity against all isolates of *C. acnes*. Particularly the performance of extract A in EtOAc displayed the lowest MIC and MBC values of 12.5 µg/ml and 25 µg/ml against JB7, and 25 µg/ml and 50 µg/ml against JB13, respectively. Notably, extract A demonstrated significant potential for antibiotic development, with even lower MIC and MBC values (6.25 µg/ml and 25 µg/ml, respectively) compared to erythromycin, which exhibited MIC of 100 µg/ml and MBC of 400 µg/ml. This research reveals the effectiveness of Thai herbal extracts in inhibiting antibiotic-resistant *C. acnes*, offering promising prospects for the development of treatments combating AMR.

Keywords: *Cutibacterium acnes*, Acne vulgaris, *Antimicrobial* resistance**,** Thai herbal extract**,** Minimum inhibitory concentrations, Minimum bactericidal concentrations

The role of *Trichoderma* spp. in biological control of brown spot disease in papaya

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Papaya (*Carica papaya L.*) is a widely cultivated fruit in tropical and subtropical climates. It is a fruit of great economic importance. Papayas have thin skin, they are susceptible to fungal infections, which results in losses both during cultivation and after harvesting. The aim of this study was to screen *Trichoderma* spp. that can inhibit fungal pathogens in isolated papaya leaves. A total of 2 isolates of *Trichoderma* spp. were isolated from soil. The dual culture method showed all *Trichoderma* isolates inhibited plant pathogen. The most effective isolates in suppressing fungal pathogens are T2 of 70.65% whereas T1 is 62.76%. The result of qualitative test of the chitinase enzyme showed that *Trichoderma* of 2 isolates breakdown of chitin into N-acetyl glucosamine causing the pH to increase, becoming alkaline and changing the color of medium from yellow to purple. The result of this study indicated that *Trichoderma* displayed competition and has the potential to be used to inhibit the growth of plant pathogen in papaya.

Keywords: *Trichoderma* spp., Fungal antagonism, plant pathogenic fungi, biological control

Antagonistic Activity of Yeasts from Mangrove Forest Against Plant Pathogenic Fungi

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Thailand is an agricultural country. One of the economic problems in agriculture is plant diseases caused by fungi, which is a challenging issue to resolve. Long-term use of chemicals in agricultural management may result in toxic residues. Therefore, the biological control is attractive approach for reducing the problem of chemical residues in the soil. Objectives of this study were (1) to investigate the antagonistic activity and possible antagonistic mechanism against plant pathogenic fungi, (2) to identify the isolated yeasts based on molecular taxonomy, and (3) to characterize the novel yeast species based on polyphasic taxonomy. A total of 30 strains were investigated for their antagonistic activity against *Fusarium melonis* (Fusarium wilt in melon) and *Penicillium allii* (Blue mold disease in garlic) by dual culture method. Only nine yeast strains can inhibit the mycelium growth of *F. melonis* by 10.7–32.1%. Whereas, 10 strains were able suppressed the mycelium growth of *Penicillium allii* by 12.5–54.1.%. Production of antifungal volatile substances (VOCs) of antagonistic yeasts were tested by dual culture in the two-partition plate, and found that no yeast was able to produce antifungal VOCs that that might effective in controlling plant pathogenic fungi. However, we found that 14 strains exhibited phosphate solubilizing on Pikovskaya's agar. All yeast strains were identified based on the analysis of the sequence similarity of the D1/D2 domain of the large subunit (LSU) rRNA gene. The result showed that 28 strains were identified as five species in the phylum Ascomycota and four species in the phylum Basidiomycota. Interestingly, seven strains were identified as a novel species in the genus *Metschnikowia*. Our findings suggest that the mangrove environment is a good source of yeasts and antagonistic yeasts

Keywords: antagonistic yeast, pathogenic fungi, biological control, plant disease

The study of arbuscular mycorrhizal fungi with mycorrhiza helper bacteria for plant growth enhancement and the development of fungal inoculant production by hydroponic system

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Hydroponic cultivation offers significant advantages in reducing the factors causing damage from traditional soil-based cultivation. It allows precise control of nutrient quantities received by plants during cultivation, resulting in increased yield and quality while minimizing soil contamination issues. However, hydroponic cultivation often raises concerns among consumers due to the potential health risks associated with the excessive use of synthetic nutrients or chemical fertilizers. Additionally, hydroponic cultivation generates low levels of organic matter in wastewater. In this greenhouse study, arbuscular mycorrhizal fungi (AMF) can enhance rice growth under hydroponic cultivation with successfully colonized rice roots at 78.67%, although the mycorrhiza helper bacteria (MHB) used did not enhance AMF colonization significantly. The findings indicate that optimal levels of organic fertilization are necessary for rice growth and AMF colonization, high fertilizer levels restricted plant growth with low AMF colonized roots. The height, fresh leaf weight, fresh root weight, and dry root weight of rice in the treatments with AMF and reduced fertilizer with electric conductivity (EC) = 1.0-1.2 are higher than the high fertilizer used EC= 1.5-1.6 treatments. Roots in these experiments exhibited favorable conditions with minimal soil attachment, reducing contamination levels and plant diseases compared to soil-based cultivation, facilitating easier research endeavors.

Keywords: mycorrhiza helper bacteria, arbuscular mycorrhizal fungi, biofertilizer, hydroponic, soilless culture

Study of Mating Type of isolated Corn Smut Fungi and Their Glycolipid Production Capability

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Ustilago maydis is a corn smut fungus infecting maize that exhibits a lower incidence of epidermal infection in Thailand compared to other regions. Corn smut fungi have been extensively researched in genetics, biochemistry, and biotechnology as a representative for understanding fungal pathogenesis in plants, genetic modeling, and biotechnological applications. This study aims to investigate the sexual reproduction of isolated corn smut fungi in Thailand using mating and confrontation assays, along with molecular biology techniques, gene-specific amplification, and DNA sequencing, to study mating-related genes including *pra1*, *pra2*, *bE*, and *bW*. The production of glycolipids was preliminarily screened based on surfactant and emulsifier properties, as well as using thin-layer chromatography to identify glycolipid types. The results showed that sexual mating and conjugation hyphae formation were not observed in any pairs among the 12 tested strains. However, molecular biology techniques revealed allelic variation of mating-related genes, hinting potential mating capabilities. Regarding glycolipid production, all 12 strains were capable of producing glycolipids with surfactant and emulsifying properties, which were separated as Ustilagic acid (UAs) and Mannosylerythritol lipid (MELs) through thin-layer chromatography.

Keywords: mating type , glycolipid , surfactant , emulsifier

Screening of microalgae *Schizochytrium* sp. isolated from mangroves for polyunsaturated fatty acids, DHA production

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Docosahexaenoic acid (DHA) is a long-chain polyunsaturated fatty acid (PUFAs) in the omega-3 group, which is an essential fatty acid that is important for brain development and function, including other nervous systems. Since DHA can only be obtained by consuming. Microalgae *Schizochytrium* sp. has the ability to produce high fatty acids, therefore, there have been many studies using *Schizochytrium* sp. in DHA production. This research aim to screen *Schizochytrium* sp. produces high amounts of the unsaturated fatty acid DHA. Three hundred forty-five isolates of *Schizochytrium* sp. were isolated from a mangrove on Andaman coast, the southern region of Thailand were screened. The results found that in the primary screen, 343 isolates of *Schizochytrium* spp. were able to produce DHA. In the secondary screen of 54 isolates, 13 isolates were found to be able to produce DHA higher than 0.919 grams per gram of cell dry weight. In the tertiary screen, 13 isolates were shown to produce DHA ranging from 0.85 to 2.37 grams per gram of dry cell weight. *Schizochytrium* sp. 11-50 can produce the highest DHA at 2.37 grams per gram of dry cell weight and DHA content 48.56 percent of total fatty acids. The second one is isolate 11-57 which has the ability to produce DHA at 2.28 grams per gram of dry cell weight and DHA content 55.65 percent of total fat acid. As a result, *Schizochytrium* sp. 11-50 produces high among of DHA, therefore, it can be studied under appropriate cultivation conditions and developed to be used as a DHA source in the future.

Keywords: DHA, DHA production, *Schizochytrium* spp., microalgae, mangroves

The study of *Trichoderma* spp. on the control of anthracnose disease in papaya

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Trichoderma is a biocontrol fungus that protects plants from diseases by stimulating their defense mechanisms against free radicals. This research is the preliminary study for screening the *Trichoderma* species that have the potential for plant pathogenic control. The effects of using *Trichoderma* spp. that were isolated from organic soils for controlling papaya diseases caused by Colletotrichum sp. have been examined through antagonist tests and chitinase enzyme activity test. The results of the antagonist test showed that both *Trichoderma* species T1 and T2 have the potential to inhibit *Colletotrichum* sp. at 74.39% and 64.26%, respectively. For chitinase production test revealed that the diameter of color changed on colloidal chitin media of T.1 is 6 cm., and T.2 is 4.1 cm. whereas the plant pathogenic fungus *Colletotrichum* sp. cannot produce chitinase.

Keywords: *Colletotrichum* sp*., Trichoderma*, antagonist test, biocontrol

Endophytic Fungi from Plant Roots in Family Orchidaceae and its application in Disease Control of *Vanilla*

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In this study, we isolated endophytic fungi from roots of 9 plants in family Orchidaceae including *Vanila planifolia, V. tahitiensis, V. pompona, Paphiopedilum sukhakulii, P. callosum, P. parishii, P. appletonianum, P. hirsutissimum* and *P. bellatulum.* Thirty-four fungal endophytes were obtained from root tissue. All of them can be classified to 17 different genera and 22 species including *Acrocalymma vagum, Areolospora bosensis, Aspergillus* sp*., Colletotrichum orchidearum, C. lentis, C. siamense, Colletotrichum* sp., *Cylindrocarpon* sp*., Diaporthe liquidambaris, D. phaseolorum, Diaporthe* sp*., Epulorhiza* sp., *Fusarium falciforme, Microsphaeropsis* sp., *Nemania* sp., *Penicillium cataractarum, Phoma* sp*., Phomopsis* sp*., Pleiocarpon livistonae, Thermothielavioides terrestris, Trichocladium pyriforme* and *Tulasnella* sp. Distribution of fungi in root of *Paphiopedilum* and *Vanila* were distinct. *Collectotrichum* was dominant in *Vanila* root (21.05%), while *Pleiocarpon* was major found in *Paphiopedilum.* Moreover, *Tulasnella* and *Epulorhiza*, which had been report as orchid mycorrhiza, were observed in root tissue of *P. callosum and P. appletonianum.* In addition, 88% of orchid root endophyte had potential in ammonium production. Only two isolates could solubilize rock phosphate that were *Cylindrocarpon* sp. PE4 and *Collectotrichum* sp. TAR1. Only five isolates could produced IAA (2.70-16.77 µg/mL). Interestingly, 97% of orchid root endophyte could be control *Fusarium solani* from 17.5 to 57.5%. This result indicated the potential of orchid root endophytes on plant growth promoting and biocontrol of soil-borne phytopathogen, *Fusarium solani.*

Keywords: *Fusarium solani*, Phytopathogen, Plant growth promoting fungi

Identification and evaluation of probiotic properties of lactic acid bacteria isolated from pickled bamboo shoots

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A total of six isolates of lactic acid bacteria were isolated from pickled bamboo shoots from Amonphan Market, Bangkok. All isolates were studied for morphological characteristics and biochemical tests. The results found that two isolates, L8-9 and L8-12 were able to auto-aggregation and co-aggregation better than other isolates. Therefore, isolates L8-9 and L8-12 were identified by 16S rRNA gene sequencing analysis. It was found that L8-9 and L8-12 were 99.72% and 99.82% similar to *Lactiplantibacillus plantarum*, respectively. This strain of lactic acid bacteria has probiotic properties. Thereby, both isolates were studied the probiotic properties, by testing tolerance to pH and bile salts, auto-aggregation and co-aggregation ability and antibacterial activity against pathogenic bacteria through *in vitro* assay. The results showed that isolates L8-9 and L8-12 were resistant to acid-alkaline conditions and bile salts. The percentage of auto-aggregation and co-aggregation is similar to that of *Lactobacillus casei* subsp. *rhamnosus*, the probiotic strain used as a positive control, 26.41% and 24.23%, respectively. Especially, isolate L8-12 had a high ability to co-aggregation when compared with all isolates of lactic acid bacteria and antibacterial activity against pathogenic bacteria, it was found that isolates L8-9 and L8-12 were able to inhibit *Escherichia coli* ATCC8739 and *Salmonella* Typhimurium DMST562. Therefore, from the results concluded that isolates L8-9 and L8-12 were resistant to gastric acid and bile salts in the small intestine. They can also auto-aggregation, co-aggregation and antibacterial activity against pathogenic bacteria, which is the basic features of being probiotics.

Keywords: Probiotic, Lactic acid bacteria, Pathogenic bacteria, Antibacterial activity against pathogenic bacteria.

Investigation of preservation conditions of *Komagataeibacter xylinus* MSKU12 for commercial applications

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Komagataeibacter is an acetic acid bacterium used in the production of vinegar and bacterial cellulose (BC). The optimal temperature for BC production is normally 25–30 °C. From our previous report, among 19 strains of *Komagataeibacter* isolated from tropical fruit in Thailand, *K. xylinus* MSKU12 produced the highest amount of BC at 37℃ so it is a promising strain for industrial BC production due to it high temperature fermentation could reduce the cost of cooling system. However, commercial applications of *K. xylinus* MSKU12 required an appropriate preservation technique to prevent bacterial contamination and changes in cell characteristics or cell death. The objective of this study was to investigate the appropriate conditions for long-term preservation of acetic acid bacteria to obtain high survival rate and stable properties. Bacterial cells grown with and without cellulase addition into culture media were preserved by the freeze-drying method using 10% skimmed milk and 1% monosodium glutamate as cryoprotectants. The harvested cells were frozen at -80℃ for 24 hours and freeze-dried in a freeze dryer. The freeze-dried samples were kept at 4℃ for 5 months. The survival rates of cell cultures grown with cellulase after freezing, and after freeze-drying at 0, 1, 2, 3, 4 and 5 months were 112.44, 82.89, 75.28, 77.51, 19.88, 30.56 and 29.76%, respectively, while the survival rates of cell cultures grown without cellulase were 85.84, 92.28, 72.94, 40.07, 39.65, 51.52 and 51.91%, respectively. Acetic acid and BC production by cell cultures grown with and without cellulase addition before freezing, after freezing, and after freeze-drying at 0–5 months were insignificantly different. However, variations in the RAPD-PCR were not observed in all preservation cultures.

Keywords: *Komagataeibacter xylinus* MSKU 12, acetic acid, bacterial cellulose, Preservation, Freeze-drying, RAPD-PCR

Identification and evaluation of probiotic properties of lactic acid bacteria isolated from soybean meal

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Seven isolates of lactic acid bacteria from soybean meal were studied for their morphological and biochemical characterization. The results showed that isolate L40-6 and L40-7 have the most probiotic properties. The 16S rRNA gene sequencing analysis showed that isolate L40-6 was 91% identical to *Lactiplantacillus plantarum*. and isolate L40–7 was 100% close to *Pediococcus acidilactici*. From the biochemical test, it was found that both isolates can ferment carbohydrates, such as glucose, xylose, mannitol, sucrose, and maltose and without hemolytic activity. In addition, they can inhibit the growth of pathogenic bacteria in the gastrointestinal tract, including *Escherichia coli* ATCC8739 and *Salmonella* Typhimurium DMST562. Also, isolate L40-6 and L40-7 were able to tolerant of high acidity and bile salt. This result was similar to the human gastrointestinal tract. Autoaggregation and coaggregation assay with pathogenic bacteria in the gastrointestinal tract were assessed. L40-6 and L40-7 showed autoaggregation ability and coaggregation with *S.* Typhimurium DMST562. These results suggested that isolate L40-6 and L40-7 have the initial properties of probiotics. However, *in vivo* experiment may be required for stability and safety evaluation.

Keywords: Probiotic, Lactic acid bacteria, Gastrointestinal pathogens

Optimization of ultrafine bacterial cellulose production in coconut water by *Komagataeibacter xylinus* MSKU 12

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Komagataeibacter is an acetic acid bacterium which can produce acetic acid and bacterial cellulose (BC) but sensitive to high temperature so it requires temperature control for fermentation between 25-30 °C. From our previous report, *K. xylinus* MSKU 12 isolated from rose apple could grow in a range of 30-37 °C and produced high amount of BC at 37 °C. BC fibril produced by *K. xylinus* MSKU 12 was ultrafine and had potential to be a raw material for biofilm production. The aim of this study is to optimize and promote BC production by statistical design and analysis. The BC production was carried out in 500 ml flask and 470 ml glass bottle containing 100 ml of coconut water consisting of 1% acetic acid, 2% ethanol, 0.5% sugar and 0.5% ammonium sulfate (CW1A2E05S05N). The amount of BC produced in flask and glass bottle were 2.70 and 5.93 g/L dry weight, respectively so glass bottle was selected for further fermentation. The experiment with the Plackett-Burman design carried out in glass bottle showed that amount of acetic acid, inoculum, cultivation time, and volume of coconut water medium significantly affect BC production yield at 37°C. Based on the Central composite design-Response surface methodology, the maximum BC amount of 15.57 g/L dry weight was obtained from static fermentation in coconut water medium containing 1% acetic acid, 10% inoculum, 200 ml coconut water medium and 12 days incubation at 37°C.

Keywords: *Komagataeibacter xylinus* MSKU 12, bacterial cellulose production, coconut water, Plackett-Burman design, optimization

Study of *Phaeogyroporus portentosus* extracts in an inhibitory effect on human papillomavirus and cervical cancer cell line CaSki and HeLa

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Phaeogyroporus portentosus or salmon gum mushroom is an edible mushroom found in Thailand, rich in various bioactive compounds. However, there have been no studies on the effects of extracts from this mushroom on inhibiting cervical cancer cells caused by human papillomavirus (HPV) infection. Therefore, this study aimed to study the effects of extracts from *P. portentosus*, extracted from fresh and dried mushrooms on the growth of CaSki (HPV16-positive cell line) using the MTT method. The water extract from fresh mushroom had a 50% inhibitory concentration (IC50) of 100.781 ± 10.862 mg/ml, which was lower toxic to cancer cells than the extract from dried (65.844 ± 1.030 mg/ml). Additionally, when testing the effects of the extracts on cell death using acridine orange/ethidium staining (AO/EB), it was found that at a concentration of 100 mg/ml, both water extracts from dried and fresh mushrooms could induce apoptotic cell death in HeLa cells more effectively than in CaSki. Furthermore, both extracts increased caspase-3 activity compared to the control group. The molecular mechanism of extracts on anti-cervical cancer was investigated by real-time polymerase chain reaction and western blot to determine mRNA levels of *BAK*, *BCL2* and HPV16E6, and p53 protein. Expectedly, the extracts upregulated *BAK* and p53 but downregulated HPV16E6 and *BCL2*. Finally, when testing the ability of the extracts to inhibit viral infection, it was found that the water extract from dried (0% in adsorption and 100% in pre-attachment) and fresh (72.17% in adsorption and 51.39% in pre-attachment) mushroom extracts reduced viral entry, indicating their potential in inhibiting HPV16 infection.

Keywords: salmon gum mushroom, human papillomavirus, cervical cancer, apoptosis

Study of *Curcuma sessilis* extracts in an inhibitory effect on human papillomavirus and cervical cancer cell lines HeLa and CaSki

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Siam Tulip, or *Curcuma sessilis* is classified as a herbaceous plant. It can be found and consumed in Thailand. This plant has various health benefits. Therefore, the objective of this study is to investigate the inhibitory effect of *C. sessilis* extracts on human papillomavirus type 16 (HPV16) and cervical cancer cell lines CaSki (HPV16-positive cervical cancer cell) and HeLa (HPV18-positive cervical cancer cell). The fresh and dried flower of *C. sessilis* were used to extract the bioactive compound by water-based extraction in 100 °C hot water and then some aliquot extracts were dried using freeze-drying process. The 50% cytotoxic concentration (CC50) of the extracts on CaSki and HeLa was determined using the MTT method. The CC50 of the extract from fresh and dried *C. sessilis* had 10.54 ± 1.47 and 3.52 ± 0.16, respectively. The apoptosis assay in treated-CaSki and HeLa was determined using acridine orange/ethidium staining staining; both extracts could increase the number of apoptotic cells in the HeLa (33.75%) more effectively than CaSki (13.88%). To confirm the effect of apoptosis result, caspase-3 activity was performed in treated CaSki. Expectedly, the extracted increased caspase 3 activity in treated group in contrast to control. The extracts can upregulate p53 and downregulate *BCL2* and HPV16E6 in treated CaSki when analyzing by western blot and real time polymerase chain reaction, respectively. Interestingly, the extracts reduced HPV16-pseudovirus infection. From these results, we demonstrates that *C. sessilis* has a potential treatment of HPV infection and cervical cancer.

Keywords: Siam tulip, human papillomavirus, cervical cancer

In vitro study on capability of natural extracts from Mempat (*Cratoxylum formosum*) on anti- human papillomavirus and cervical cancer cell lines HeLa and CaSki

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Human papillomavirus is considered the main cause of cervical cancer, especially the high-risk type (HR-HPV) such as HPV16 and HPV18. Though the effects of the virus infection are severe and widely spread, the treatment itself is still limited. Conducing to this study's objective is to examine the antiviral effect of the natural extract from the local herb called Tiew (*Cratoxylum formosum*) for perhaps giving us an alternate way to up against this virus. Several extracts showed cytotoxic properties in screening tests in cervical cancer cell lines (HeLa and CaSki) using MTT assay and apoptosis assay using acridine orange/ethidium bromide dye. Unidirectionally, in virucidal test with pseudovirus, most of the extracts still represent the potential virucide for HPV infection. Ultimately, one of the extracts, dried-ethanol has shown the ability to increase the expression of p53 protein. In summary, we suggest that the natural extract from *C. formosum* has the potential to be antiviral factor against HPV with dried-ethanol representing the highest potential, and further study is needed to bring the benefit out of its potency.

Keywords: HPV, Tiew, Mempat, *Cratoxylum formosum*, extract, antiviral

Study of *Lasia spinosa crude* extracts in an inhibitory effect on human papillomavirus type 16-infected and cervical cancer cell line CaSki and HeLa

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Lasia spinosa, classified within the Araceae family, is a herbaceous plant characterized by sharp spines along its stems. It is native to the tropical regions of Southeast and South Asia. Commonly consumed by local communities, Lasia spinosa is often boiled or stir-fried, with a preference for its tender shoots and stems. However, caution is advised as its leaves, leaf stems, and stems contain Cyanogenic Glycosides, which can convert into toxic cyanide compounds affecting blood circulation. Pharmacological studies have reported the plant's anti-malarial properties, particularly its effectiveness against *Plasmodium falciparum* and FM3 A at concentrations below $EC50$ <10 micrograms/mL. Additionally, extracts from *Lasia spinosa* have shown antioxidant and anti-inflammatory properties in various studies. However, there is a lack of research regarding its effects on cervical cancer cells. In this study, researchers aimed to investigate the inhibitory effects of extracts from fresh and dried *Lasia spinosa* on CaSki and HeLa cells infected with human papillomavirus type 16 (HPV16). The result showed that dried extract inhibit cervical cancer cells.

Keywords: *Lasia spinosa*, human papillomavirus, cervical cancer

Isolation and selection of anti *Candida albicans* metabolites producing lactic acid bacteria and evaluating their antifungal activity

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Forty-seven isolates of lactic acid bacteria obtained from 13 samples of fermented foods and fruit effluents were screened on De Man Rogosa Sharpe (MRS) agar. Identification of lactic acid bacteria was based on morphological and biochemical characteristics. This study primarily investigated the probiotic potential of these lactic acid bacteria, focusing on their ability to inhibit the growth of *Candida albicans* and *Aspergillus flavus*. Seven isolates did not exhibit hemolysis reactions. Among these, isolate S5-6 demonstrated optimal growth in medium supplemented with Oxgall concentrations ranging from 0.1 to 3.0 for 24 hours during bile salt tolerance testing. Isolates S5-7 and S6-4 showed resistance to the antibiotic Norfloxacin. Isolate S6-1 displayed growth in acidic conditions ranging from pH 3 to 6, significantly higher than *Lactobacillus casei* subsp. *rhamnosus,* a probiotic strain used as a positive control. In auto-aggregation and co-aggregation assays with gastrointestinal pathogenic bacteria, isolate P1-1 exhibited significantly higher adhesion percentages compared to other isolates, including *L. casei* subsp. *rhamnosus.* Moreover, P1-1 and S6-1 showed the highest effectiveness in inhibiting the growth of gastrointestinal pathogenic bacteria, especially *Escherichia coli* ATCC873 and *Salmonella* Typhimurium DMST562. Secondary metabolites of six isolates were found to inhibit the growth of *C. albicans*, with isolate P1-1 displaying the maximum inhibition zone of 20.6 millimeters using the overlay method. Additionally, P1-1 demonstrated significantly higher inhibition percentages of *A. flavus* growth compared to the control. In conclusion, lactic acid bacteria isolate P1-1 from kimchi exhibited inhibitory effects against *C. albicans* growth and displayed superior antifungal properties among all lactic acid bacteria isolates. Moreover, this isolate demonstrated resistance to gastric acid, bile salts in the small bowel, auto-aggregation, co-aggregation, and pathogenic inhibitory activity, in addition to fundamental probiotic characteristics.

Keywords: Probiotics, Lactic acid bacteria, Antifungal, Gastrointestinal pathogenic bacteria.

Isolation of thermo-stable isolates from traditional fermented food and their safety evaluation.

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Probiotics are live microorganisms providing therapeutic effect to human. However, these microorganisms tend to have poor stability in heat-treated food products. Therefore, the objective of this research is to find thermotolerant microorganisms presented in traditional fermented foods, such as kimchi, sweet fermented rice, and pickled vegetables. Representatives from various heat-treated Thai traditional fermented vegetable were selected. Each isolate was then tested for morphological characteristics including gram staining and endospore staining, biochemical properties including acid production, salt tolerance and starch hydrolysis. Candidate isolates were further determined for their safety property of hemolysin, concomitantly with strain identification using 16S rRNA sequencing approach. A commercial probiotic of *Bacillus coagulans* was use as a reference strain. From a total of 116 microbial isolates isolated from fermented samples, four isolates were found; F12-1, F13-1, F13-2, and F13-3, which had acid production properties, starch hydrolysis properties, salt tolerance properties, non-hemolysis properties, and have been identified as being safe. These four microbial isolates will further be tested for other properties in the future.

Keywords: Probiotics, Traditional fermented food, *Bacillus coagulans*

Study on storage of Look-pang from Sakthongwinery and the survival ability of microorganisms in Look-pang after being stored for different periods and temperatures by the total count method

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In Asia, Look-pang is a popular innovation in liquor making Sato. It was created to regulate the quality of fermented alcohol and guarantee a constant level of quality. Yeast and mold are the primary microbes in the Look-pang that cause the process of alcohol formation. The major fungal species that are frequently discovered in Look-pang in Thailand are *Rhizopus* spp. and *Amylomyces* spp. The major yeast is *Saccharomyces* spp. and *Saccharomycopsis* spp. The molds transforms starches from rice to sugar during the alcohol fermentation process and producing acid. The yeast produces taste and alcohol by using the sugars from the molds. However, when tainted by undesirable germs, as a result, the Rice Wine will taste sour or won't have the proper quality. This research was conducted to study the ability of microorganisms to survive in Look-pang stored at different temperatures and for different periods of time by performing a total count. To study what types of microorganisms are present in the Look-pang. The Look-pang used in this study were obtained from the Sakthongwinery. The Look-pang are soft white and have a diameter of approximately 3 centimeters the weight is between 9-10 grams. Look-pang were kept at four different temperatures -20, 4, 23–25, and 33–35 degrees celsius—with varying shelf lives of 15 days, 30 days, 2 months, 4 months, and 6 months to research the best temperature and time to store Look-pang by total count method. Results of the investigation revealed the presence of microorganisms predicted to belong to the species *Rhizopus* spp., *Saccharomycopsis* spp., and *Saccharomyces* spp. in the Look-pang samples. Furthermore, the ideal temperature for storing Look-pang is 4 degrees celsius. This is due to the high survival rate of yeasts and molds, both of which are essential to the fermentation process.

Keywords: Look-pang, Rice wine, Preservation, Enumeration

The study of synthetic microbial community for kombucha fermentation

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Most kombucha production are generally conducted by starter culture derived from previous fermentation batch. Therefore, an awareness in a microbiological risk of pathogen contamination due to these back-sloping technique is marked. The ecology and complexity of metabolical-active microorganisms during fermentation are also largely unknown. Hence, the aim of this research is to develop kombucha production by using well-defined synthetic culture. This makes it possible to control fermentation process, resulting in a programmable-kombucha product. Production can be predicted and is safe for consumers. The study revealed that kombucha produced using a synthetic culture exhibited a pH value of 3.14, an average SCOBY size of 0.25 centimeters, a total sugar content of 0.38 g/L, an alcohol content of 13.75 %, and a total reducing sugar content of 0.67 g/L. The total phenolic and total flavonoid content were highest on day 21 of fermentation, with values of 0.19 mg/mL and 0.54 mg/mL, respectively. The highest concentrations of acetic acid bacteria and yeast were observed on day 7 of fermentation.

Keywords: Synthetic starter culture, Kombucha, Fermentation

Identification and screening of indole-3-acetic acid producing bacteria isolated from mangrove soil in rainy season

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Mangrove forest is the ecosystem that located between land and sea in the tropics and subtropics. It is containing many species of plants and animal live in brackish muddy soil and flooded with seawater environment. Using plant growth promoting bacteria (PGPB) is one of strategies of forest reforestation. Sixty-two bacterial isolates were obtained from mangrove soil in the International Mangrove Botanical Garden Rama IX, Chanthaburi Province, during a rainy season. Analysis of 16S rRNA gene sequences revealed a highly diverse bacterial community consisting of 22 species in ten genera, namely *Curtobacterium, Leucobacter, Bacillus, Marinomonas, Photobacterium, Priestia, Proteus, Rossellomorea, Staphylococcus*, and *Vibrio*. The two most abundant species were *Staphylococcus saprophyticus* (10 isolates) and *Priestia megaterium* (7 isolates). The Shannon-Wiener diversity index of soil bacteria was 2.79. Production of indole-3-acetic acid (IAA) was determined by the Salkowski reagent method. Fifty-three isolates were positive on IAA production. The highest IAA producing bacteria in this study was *Staphylococcus saprophyticus* RS7-5 (160.84 µg/ml), followed by *Priestia megaterium* RS11-14 (128.18 µg/ml), and *Priestia koreensis* RS7-10 (123.09 µg/ml).

Keywords: Mangrove, Plant growth promoting bacteria (PGPB), IAA production

Ultraviolet treatment for vitamin D fortification in mushrooms and production of their functional fermented food products

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The interest in consuming food rich in Vitamin D is increasing because most Thais are deficient in Vitamin D. Vitamin D deficiency highly impacts on osteoporosis, hair loss, etc. Therefore, people are turning their attention to vitamin D-supplemented food products. Mushrooms are a food that is high in nutritional value. The phytosterol found in mushrooms is ergosterol. When the mushroom cap is exposed to ultraviolet (UV) light at a wavelength of 280-320 nm, the photolysis process occurs. The chemical structure of ergosterol changes to ergocalciferol or Vitamin D2. This research was therefore conducted to study and develop the process of increasing the amount of Vitamin D in kimchi by choosing oyster mushrooms (*Pleurotus ostreatus*) and black wood ear mushrooms (*Auricularia cornea*) as ingredients and using UV light exposure to increase the Vitamin D availability in the mushrooms. It also studied the feasibility of producing kimchi from mushrooms with increased Vitamin D, solving the problem of mushroom oversupply, and adding value to mushrooms. It was found that when the antioxidant properties of oyster mushrooms had better antioxidant efficiency than black wood ear, while FRAP antioxidant value shown no significant difference in both mushroom. The Total Phenolic FOLIN assay showed that black wood ear mushrooms kimchi had better antioxidant efficiency than oyster mushrooms. The Determination of vitamin D2 by trifluoroacetic acid method showed that kimchi that used oyster mushrooms and black wood ear mushrooms as ingredients had an increased amount. In particular, kimchi made from black wood ear mushrooms had a higher amount of Vitamin D than kimchi made from oyster mushrooms.

Keywords: Functional fermented food, mushrooms, vitamin D, Ultraviolet

Identification and characterization of indole-3-acetic acid producing bacteria isolated from soil of mangrove forests during dry season

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The presence of plant growth-promoting bacteria (PGPB) can alleviate the effects of biotic and abiotic stressors on plants. To further understand the potential benefits of PGPB in mangrove ecosystem and restoration, this study aimed to identify bacteria associated with the soil around Rhizophora apiculata, and select bacteria that produce indole-3-acetic acid (IAA). Thirty-eight bacterial isolates were obtained from mangrove soil in the International Mangrove Botanical Garden Rama IX, Chantaburi province, during a dry season. Based on 16s rRNA gene analysis, these isolates were classified into 3 the phylums of 16 different genera of 3 phylums; the phylum Actinobacteria (5 isolates in the genus Agromyces, Microbacterium, Micrococcus, and Prescottella), Firmicutes (27 isolates in the genus Bacillus, Brevibacillus, Neobacillus, Priestia, Rossellomorea, and Staphylococcus), and Proteobacteria (6 isolates in the genus Alcaligenes, Shewanella, and Vibrio). The most abundant species in the mangrove soil during the dry season was Staphylococcus saprophyticus and Vibrio alginolyticus (founded in 3 locations). The Shannon-Wiener diversity index was 2.95. Most isolates were positive on IAA production. The highest IAA producing bacteria was Bacillus altitudinis SS9-3 (43.64 ug/ml), followed by Priestia megaterium SS9-4 (37.51 ug/ml).

Keywords: Mangrove, Plant growth-promoting bacteria (PGPB), IAA production

Effect of UV and moltodextrin toward shelf life of fermented muchroom products.

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Mushrooms are an agricultural product with high nutritional value but it is easily perishable, even through the process of fermentation. Therefore, the research idea is to use physical and chemical methods to extend the shelf life of wood ear and oringii mushroom fermented products. using kimchi as a model. The first step of the research was UV treatment (wavelength of 254 nm for 5 and 10 minutes) to eliminate microorganisms on the surface and soften the structure. A formulation using maltodextrin as a new type of carbohydrate source in order to retard the fermentation rate was compared to the traditional one using glutinous rice flour. The physical properties (CO_2, pH), chemical (lactic acid and total sugar) and microbiological properties in the form of total microorganisms were analyzed after 45 days of fermentation. The sugar content in traditional formula increased sharply comparing with maltodextrin treatment. The maltodextrin formula had lower CO_2 values, while their pH value was higher than that of glutinous rice flour. This indicated a longer shelf life of mushroom kimchi using maltodextrin than a traditional one. Moreover, the initial bacterial count was higher in glutinous rice flour than in maltodextrin. The results showed that the fermentation rate of the maltodextrin formula was slower than that of the glutinous rice flour, thus a shelf-life extending of mushroom kimchi using maltodextrin is possible.

Keywords: Fermentation, Maltodextrin, Shelf life, Kimchi, Mushroom

The total amount of microorganisms in luk paeng from Kaeng Sua Ten kept in different temperature and time

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Luk paeng is a local fermentation technique crucial for determining the quality and taste of Sato, a traditional fermented beverage. The microbial composition of Sato includes various species such as *Amylomayces* spp., *Rhizopus* spp., *Aspergillus* spp., and yeast which are *Saccharomyces* spp. and *Saccharomycopsis* spp. particularly influencing the fermentation process. However, contamination from undesirable bacteria like *Acetobacter* spp. and *Bacillus* spp. can lead to a sour taste, often attributed to the storage conditions of Luk paeng and the raw materials used. This research aimed to investigate the impact of different storage conditions on the microbial population in Luk paeng over time. Luk paeng from Kaeng Suea Ten, Phrae Province, were used in this research. Luk paeng were stored at various temperatures: 25°C, 4°C, -20°C, and room temperature. Microbial counts were conducted after storage periods of 30 days, 1 month, 2 months, 4 months, and 6 months to identify the most suitable conditions.Results revealed the presence of microorganisms associated with Sato fermentation, including *Rhizopus* spp., *Aspergillus* spp., *Saccharomyces* spp. and *Saccharomycopsis* spp. in Luk paeng samples. The results of total microbial count was decreased with prolonged storage across all temperature conditions. In this research, the results show temperatures of 4°C and -20°C emerged as the most suitable for storage and preserving the number of microorganisms in Luk paeng which important for fermentation process.

Keywords: Luk paeng, Sato, Total microbial count

Biological control from rhizospheric bacteria of *Mangifera* spp for controlling of *Phytophthora palmivora*, the causing agent of *Durio* spp

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Mangifera species, a perennial crop, is commonly grown around the house areas in Thailand. This study isolated rhizospheric bacteria from *Mangifera* to determine their antagonistic activity against *Phytophthora palmivora* which is the causative agent of fruit rot on durian. In general, the disease is managed by synthetic chemicals. However, constant overusing of the chemicals may lead to resistant pathogen isolates. Biological control can be used as an alternative approach to decrease the impact of chemical applications. In this research, we conducted a dual culture method to test the abilities of the isolated rhizospheric bacteria to control the growth of *P. palmivora* on the agar medium. Six out of 138 isolates showed antagonistic activities. The percentages of inhibition of radial growth (PIRG) ranged from 28.9 - 77.8%. The isolate BKK08 and LBR25 had approximate 1.7 times inhibition activity higher than metalaxyl, which was used as the positive control. According to biochemical characteristics, the isolate BKK08 was identified as *Pseudomonas* sp. and the other five isolates, including LBR25, NAN05, NAN13, SNG02, and ANG12, were *Bacillus* species. The results showed that the isolates BKK08 and LBR25 could be used as potential biological control agents.

Keywords: Biocontrol, Rhizosphere, Durian, *Phytophthora palmivora*

Fungi isolated from mangrove sediment in summer and potential for plant growth promoting properties and inhibition of soil-borne pathogen, *Fusarium solani*

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Isolation of fungi from mangrove soil sediment in summer season with different techniques by 1) Heat treatment, 2) ethyl alcohol treatment and 3) incubation under styrene atmosphere. Thirty-five fungal isolates were obtained. Identification based on morphological and molecular genetic features revealed that they belong to two phylum, Ascomycota (94%) and Basidiomycota (6%). All of them can be classified to 13 different genera and 25 species including *Aspergillus siamensis, A. spinosu*s, *Bjerkandera fulgida, Cladosporium dominicanum*, *C. velox*, *C. sphaerospermum, Curvularia lunata, Fereydounia khargensis, Kalmusia* sp., *Paecilomyces niveus*, *Paecilomyces* sp*., Penicillium lineolatum*, *P. javanicum*, *P. ornatum*, *P. terrenum, Penicillium sp., Periconia thailandica*, *Ramichloridium apiculatum*, *Septoriella oudemansii*, *Scolecobasidium musae, S. humicola*, *Talaromyces brevis, T. trachyspermus T. muroii* and *Talaromyces* sp. Fungi in genus *Aspergillus, Penicillium* and *Talaromyces* were mainly obtained in soil sediment with heat and alcohol treatment, while these 3 genera were not found in styrene treatment. The genera that major in styrene treatment was *Cladosporium.* 62, 44 and 26 percentage of fungal isolated from mangrove soil sediment have potential in ammonia production, rock phosphate solubilization and Indole-3-acetic acid (IAA) production, respectively. *Paecilomyces niveus* SS9H1 and *Bjerkandera fulgida* SS11S1 most effective on *Fusarium solani* inhibition as 52.29% and 47.47% , respectively. Moreover, *Bjerkandera fulgida* SS11S1 could product highest IAA (55.34 ± 0.38 µg/mL). This result indicated the potential of mangrove soil sediment in plant growth promoting and biocontrol of soil-borne phytopathogen, *Fusarium solani.*

Keywords: *Fusarium solani*, Mangrove soil sediment, Phytopathogen, Plant growth promoting fungi

Fungi isolated from mangrove sediment in rainy season and potential for plant growth promoting properties and inhibition of soil-borne pathogen, *Fusarium solani*

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Isolation of fungi from mangrove soil sediment in rainy season with different techniques by 1) Heat treatment, 2) ethyl alcohol treatment and incubation under styrene atmosphere. Thirty-two fungal isolates were obtained. All of fungal isolates belong to phylum Ascomycota based on identifications on morphological and molecular genetic features. All of them can be classified to 12 different genera and 26 species including *Aspergillus subversicolor, A. sydowii Aspergillus* sp., *Cladosporium sphaerospermum. C. halotolerans, C. oxysporum, Clonostachys swieteniae, Curvularia radicicola, Ectophoma multirostrata, Neosartorya spinose*, *Paecilomyces niveus, Penicillium javanicum, P. lineolatum, Penicillium terrenum, Penicillium shearii, Penicillium* sp*., Purpureocillium roseum, Ramichloridium apiculatum, Sporisorium scitamineum, Talaromyces angelicus, T. bacillisporus, T. flavus, T. macrosporus*, *T. muroii, T. trachyspermus* and *T. verruculosus. Talaromyces* was frequently found in soil sediment with heat and alcohol treatment, while this genus was not found in styrene treatment. The major genus was found under styrene treatment as *Aspergillus.* 81.25, 40.62, and 15.63 percentage of fungal isolated from mangrove soil sediment have potential in ammonia production, Indole-3-acetic acid (IAA) production and rock phosphate solubilization respectively. *Curvularia radicicola* RS6S2 and Paecilomyces niveus RS11A1 most effective on *Fusarium solani* inhibition as 50 and 47.5% respectively. Moreover, *Aspergillus* sp. RS12S1 could product highest IAA production (86.62 µg/mL) and this isolated also had portent in ammonia production and rock phosphate solubilization abilities. This result indicated the potential of mangrove soil sediment in plant growth promoting and biocontrol of soil-borne phytopathogen, *Fusarium solani* that could be applied to improve agricultural production according to sustainable agricultural development guidelines with eco-friendly approach.

Species Identification and Screening of Bioplastic-Degrading Yeast

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Bioplastics have become a popular plastic used in many products and industries, due to their ability to degrade under a specific condition. However, it is hard to degrade in nature by itself. Consequently, biodegradation is the most eco-friendly approach for bioplastic waste management. Objectives of this study were (1) to identify the isolated yeasts based on molecular taxonomy, (2) to characterize the novel yeast species based on polyphasic taxonomy, and (3) to investigate the ability of yeasts to degrade bioplastics, polylactic acid (PLA), and poly-butylene succinate (PBS). Sixty yeast strains were obtained and identified based on the analysis of the sequence similarity of the D1/D2 domain of the large subunit (LSU) rRNA gene. Among them, 32 strains were identified as four species in the phylum Ascomycota (*Kodamaea ohmeri*, *Metschnikowia chrysomelidarum*, *Metschnikowia koreensis* and *Starmerella meliponinorum*) and three species in the phylum Basidiomycota (*Papiliotrema flavescens*, *Pseudozyma hubeiensis* and *Rhodotorula sphaerocarpa*). In addition, we found that six strains were two yeast-like fungal species i.e. *Aureobasidium melanogenum* and *Quambalaria simpsonii*. Interestingly, six strains were identified as a novel species. All 60 strains and other 50 strains obtained from the private culture collection were investigated for their ability to degrade two types of bioplastics. Only three strains (*P. flavescens* DMKU-FR12, *P. laurentii* DMKU-SGM17 and *P. siamense* DMKU-SY42) showed bioplastic degrading activity on yeast nitrogen base (YNB) agar containing PLA and PBS as the sole carbon source. Among them, *P. flavescens* DMKU-FR12 showed the highest lipase activity with enzymatic index (EI) of 2.45. *P. flavescens* DMKU-FR12 and *P. siamense* DMKU-SY42 produced esterase enzyme with EI 1.62 and 1.50, respectively, these enzyme are involve in bioplastic-degrading. Our findings suggest that the mangrove environment is a good source of yeasts and bioplastic-degrading yeasts. The mechanisms of bioplastic degradation need to be further investigated.

Keywords: yeast, bioplastic-degrading yeast, polylactic acid, poly-butylene succinate.

Actinobacteria from Mangrove Soil and their Ability to Produce Cellulase and Protease

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Actinobacteria have ability to produce extracellular enzymes. Cellulases and proteases are important because of its enormous commercial values and used in various industrial applications. In this study, actinobacteria were isolated from soil samples collected from International Mangrove Botanical Garden Rama 9, Chanthaburi province, using starch casein agar supplemented with 2.5% NaCl. In total, 30 strains of actinobacteria were isolated. All isolates were tested for cellulase and protease activities on carboxymethyl cellulose agar and skim milk agar respectively, without and with 2.5% NaCl. The results showed that 10 isolates showed cellulase activity on media without NaCl and seven isolates on media with NaCl. Seventeen and 22 isolates showed protease activity on media without and with NaCl, respectively. Isolates RSS4.7 showed the highest ability to produce cellulase, with cellulase hydrolysis capacity value 3.17 on media without NaCl and 2.17 on media with NaCl. Isolates RSS4.4 that showed the highest ability to produce protease with protease capacity value 2.34 on media without NaCl and 2.12 on media with NaCl. These two isolates (RSS4.4 and RSS4.7) were subjected to molecular identification by sequencing of 16S rRNA gene. The result showed that isolate RSS4.4 shared 99.70% similarity to *Streptomyces albidoflavus* DSM 40455^T, whereas isolate RSS4.7 showed 100% similarity to *Streptomyces salinarius* SS06011^T.

Keywords: Actinobacteria, Mangrove, Cellulase, Protease

Biological control from rhizospheric fungi of *Mangifera* spp. for controlling of *Phytophthora palmivora*, the causative agent in *Durio* spp.

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Phytophthora palmivora infects durian fruits causing fruit rot that leads to tremendous economic losses. Synthetic chemical fungicides are frequently used to minimize the impact from the infection. However, excess chemical treatments can lead to the resistant strains. Our study aimed to investigate the biological control agents to alter the control programs. We isolated the rhizospheric fungi from *Mangifera* species that are grown throughout Thailand. A collection of 204 isolates were obtained from eight provinces. After prescreening and performing a dual culture test, 20 isolates showed greater than 60% inhibition of radial growth (PIRG) of *P. palmivora* on potato dextrose agar. The maximum inhibition was 90.2% recognized in the isolate SBR001, which was significantly different from the other isolates and the positive control. The isolate SBR001 was morphologically identified; however, the characteristics of the rhizospheric fungus were not sufficient and not yet named. It will be further determined using other methods.

Keywords: Biological control, Fruit rot, *Phytophthora palmivora*, Rhizospheric fungi

Screening and optimization of culture media for DHA and astaxanthin production by microalgae *Schizochytrium* sp.

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Microalgae are important renewable sources of carotenoids and polyunsaturated fatty acids (PUFAs) that the human body cannot synthesize on its own. Especially DHA and astaxanthin, which are substances rich in benefits and have high economic value. Previous studies shown that *Schizochytrium* sp. can produce astaxanthin and high amounts of fatty acids. The purpose of this research is to screen *Schizochytrium* sp. belongs to the group thraustochytrids that can produce high levels of astaxanthin and DHA fatty acids and to find appropriate cultivation conditions to increase production potential. From the screening of 4 isolates of *Schizochytrium* spp. found that isolate 33 had the highest potential to produce astaxanthin amounts of 81.54 and 88.92 ug g^{-1} cell dry weight and produced DHA 37.34 and 41.30% of the total fatty acids at 7 and 10 days, respectively. Study of the composition of the appropriate culture medium for growth and production of DHA and astaxanthin. It was found that the suitable medium was GPY (Glucose Peptone Yeast extract) formula containing 3% Glucose, 1% peptone and 1% yeast extract. The suitable carbon source was glucose, which yielded astaxanthin concentration at 18.52 and 30.72 ug g^{-1} cell dry weight, produced 12.60 and 13.28% DHA of total fatty acids at 7 and 10 days, respectively. The appropriate type of nitrogen source was yeast extract, which provided astaxanthin amounts of 73.33 and 113.71 ug g^{-1} cell dry weight, produced DHA 29.54 and 14.65% of total fatty acids at 7 and 10 days, respectively.

Keywords: Astaxanthin, DHA, *Schizochytrium* sp., Microalgae

Optimization of culture condition for growth, fatty acid DHA and pigment astaxanthin production of microalgae *Schizochytrium* sp.

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Schizochytrium sp. is one of the most extensively studied marine microalgae for production of docosahexaenoic acid (DHA) which is a type of omega-3 fatty acid important for brain development and human health. This microorganism has shown significant potential for carotenoid production, such as astaxanthin which has great antioxidant and anti-inflammatory properties, as well as its health effects on diabetes, cardiovascular diseases, cancer, and so on. The objective of this experiment was to study and compare optimal culture conditions for growth, production of fatty acids DHA and astaxanthin pigment. Cultivation of *Schizochytrium* sp. 51 in the culture media under 5 different conditions (pH, temperature, salinity, air, light) for 7 and 10 days. Then, samples of algae growing in each medium were collected and used to extract astaxanthin, measure their growth, and analyzed the amount of PUFAs using gas chromatography. The results of the experiment found that the culture *Schizochytrium* sp. 51 at 7 days had the ability to produce higher fatty acids and pigments than the 10 days culture. The optimum conditions for astaxanthin production were pH 10, salinity 0 ppt, air (volume of media) 10 ml, and moderate light (covered with wax paper) had values of 1.6482, 6.0744, 3.8074, and 0.5552 μg/gCDW, respectively. The highest DHA fatty acid production at pH 6, salinity 0 ppt, air (volume of media) 15 ml, and dark (covered with foil) were 2.9219, 42.1963, 182.5394, and 17.422 g/gCDW, respectively.

Keywords: *Schizochytrium* sp., docosahexaenoic acid (DHA), astaxanthin

Selection of Green Microalgae and Study of Culture media for Polyunsaturated Fatty acids Production

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Polyunsaturated fatty acids (PUFAs) are fatty acids that have two or more double bonds in the molecule. They are essential for mammals that cannot synthesize these fatty acids on their own but must be obtained through consumption. They are also very important for the body; they help the function of important organs, reduce the amount of cholesterol in the blood, and help to form new cells. These fatty acids are derived mainly from sea fish, but the supply is insufficient. There are reports showed that microalgae could produce high amount of PUFAs. The objectives of this research are to select green microalgae with the ability to produce high amount of PUFAs and to study the suitable culture media for PUFAs production. Six isolates of green microalgae were grown in six types of media. After that, samples of algae growing in each type of medium were collected for 15 days and analyzed for PUFAs content using gas chromatography. The results indicate that green microalgae isolates 2.1.1 and 7.18 had a higher potential to produce PUFAs than other isolates, and the media that promoted PUFAs production better than other media were BG 11 and NSIII media.

Keywords: Microalgae, Polyunsaturated fatty acids, Microalgae culture medium

Actinobacteria from *Rhizophora apiculata* and their plant growth promoting activities

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In this study, actinobacteria were isolated from leaves sample of *Rhizophora apiculata*, collected from the Rama IX International Mangrove Botanical Garden, using starch casein agar. Pure isolates were studied for their morphological characteristics on ISP2 and ISP3 media. The results showed that a total of 21 actinobacteria isolates were classified to 5 groups based on spore color: gray, white, yellow, orange, and a group that did not produce spores. These isolates were studied for their ability to produce plant growth-promoting activities. The results showed that all isolates were able to produce siderophore on Chrome azurol S (CAS) agar. Eleven isolates could convert insoluble phosphate into soluble forms on Pikovskaya's (PVK) agar and twelve isolates were able to produce indole-3-acetic acid (IAA). Two isolates namely 1LY8.4 and 1LY10.5 which showed high levels of plant growth-promoting activities were identified using 16S rRNA gene sequence. The result showed that isolate 1LY8.4 was *Streptomyces mexicanus* CH-M-1035^T with similarity of 99.55% and 1LY10.5 was *Actinomycetospora corticicola* 014-5^T with similarity of 100%. This study shows that leaves of *Rhizophora apiculata* is reservoir of actinobacteria that can produce plant growth-promoting activities.

Keywords: Actinobacteria, *Rhizophora apiculata*, Plant growth promoting activities

Screening of microalgae *Schizochytrium* sp. for DHA production form Andaman coast, Southern of Thailand

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Docosahexaenoic acid (DHA) is omega-3 polyunsaturated fatty acids (PUFAs) that are essential for the human body because the body does not have the capacity to synthesize them, therefore it needs to be obtained from consumption. Previous studies have shown that *Schizochytrium* spp. has high lipid production capacity. Currently, there is research related to the introduction of microalgae in groups of Thraustochytrids utilized by focusing on the production of DHA. In this research has taken *Schizochytrium* spp., isolated from the Andaman coast that were screened. The aim of the current study was to find isolates capable of producing high amounts of DHA unsaturated fatty acids. Three hundred and twelve isolates of *Schizochytrium* spp. were isolated and screened from Andaman coast, which were collected from Southern of Thailand. The results showed that all isolates were able to produce DHA and 57 isolates were found to produce more than 28% of DHA total fatty. In the secondary screen of 57 isolates, 15 isolates were found to produce more than 0.60 g/g_{CDW} and *Shizochytrium* sp. 15-178 produce highest DHA production, 1.488 g/g_{CDW} and 9.630 g/L. Therefore, *Schizochytrium* spp. isolates 15-178 with high DHA production capacity can be studied and developed to replace DHA from marine fish in the future.

Keywords: DHA, *Schizochytrium* sp., Microalgae, Thraustochytrids

Fungi isolated from Mangrove Plant (*Rhizophora apiculata* Blume) and potential for plant growth promoting properties and inhibition of phytopathogen , *Colletotrichum gloeosporioides*

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This study aimed to isolate and identify of fungi on leave of *Rhizophora apiculata* and characterize their potential in plant growth promotion and control of plant pathogenic fungi, *Colletotrichum gloeosporioides.* We collected 12 leave samples for isolate fungi on Martin's rose bengal medium supplement with 3% and 10% NaCl. Twenty-nine fungal isolates were obtained. All of them belong to phylum Ascomycota based on identifications of their morphological and molecular genetic data. All of them can be classified to 9 different genera and 11 species including *Aspergillus tubingensis, A. sydowii, A. unguis, Pseudopestalotiopsis theae., Cladosporium pseudotenuissimum, Curvularia spicifera, Dothideomycetes* sp*., Fusarium equiseti, Hortaea werneckii, Lophiostoma* sp. and *Neodevriesia* sp. The genus *Neodevriesia* was frequently observed from plant leave on high salt concentration medium. Twelve isolates (41.38%) were obtained. All of them show highest similarity of ITS sequence with *Neodevriesia pakbiae* as 98%, implied that this potent as novel species. Seventy percentages of fungi on leave of *Rhizophora apiculata* had potential in Indole-3-acetic acid (IAA) production. *Hortaea werneckii* 9Y3M1 could produce highest among of IAA (48.31±0.03 µg/mL) In addition, 58.62 and 34.48% of fungi on plant leave had potential in ammonia production and rock phosphate solubilization, respectively. Eleven isolates could be control plant pathogenic fungi, *Colletotrichum gloeosporioides. Fusarium equiseti* E7-1 had highest ability to control them. This result indicated the potential of fungi from *Rhizophora apiculata* leave in plant growth promoting and biocontrol of plant pathogenic fungi, *Colletotrichum gloeosporioides*

Keywords: *Rhizophora apiculata* leave, plant growth promoting fungi, *Colletotrichum gloeosporioides*

Comparative of Microalgae and Microplastic in Kasetsart University, Bangkhen Campus

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Microplastic contamination in various ecosystems, including soil, water, and organisms like vascular plants, has been extensively studied worldwide. However, the specific interplay between microplastics and microalgae in aquatic environments, particularly in Thailand, requires further exploration. This study aimed to quantify the presence of microplastics and microalgae in water bodies and investigate their relationship. Sampling was conducted at Kasetsart University from September to December, focusing on three distinct sampling points. Comprehensive assessments of the quantities of microalgae and microplastics were determined using 10-liter water samples filtered through a 21-micrometer mesh net. All experiments were conducted with three replicates. Results revealed the physical characteristics of the water samples, with the measured microalgae biomass at 17.1×10^{-5} milligram per liter, reaching its peak in December at 26.64×10^5 units per milliliter and its lowest point in September at 10.66×10^5 units per milliliter. The average microplastic content was highest in November at 94.84×10^4 units per milliliter and lowest in September at 13.37×10^4 units per milliliter. In addition, water quality was measured in each sampling points. The result of the study showed that Kasetsart University had an average 568.13 microcegment per centimeter for conductivity, 4.03 milligram per liter for dissolved oxygen and 23.35 FNU for turbidity. Correlation analysis revealed a positive relationship between microalgae and microplastic contents in September and December, with correlation coefficients (r) of 0.042 and 0.453, respectively. Conversely, October and November displayed negative correlations, with r values of -0.042 and -0.48. The results of this study provide valuable insights for further study on the initial quantities of microplastics impacting small aquatic organisms, such as microalgae, in water bodies.

Keywords: Relationship, Extraction, Microplastic, Microalgae, Thailand

Influence of air relative humidity on a response of *Nepenthes* pitchers

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Nepenthes, a carnivorous plant genus, includes several species that are classified as vulnerable due to changing weather conditions affecting their abnormal growth. This research aims to study the influence of air relative humidity on a response of *Nepenthes* pitchers, by cultivating a hybrid species called *Nepenthes × ventrata* under different two air relative humidity levels. Ambient environment had a humidity of 67.06±11.94%, while high humid environment had a humidity of 95.77±9.44%. The results showed that the pitchers of *Nepenthes* exhibited distinct characteristics in each environment. Ambient environment had fewer pitchers but larger pitcher sizes compared to the high humid. The average number of pitchers was 1.30±0.56, with an average pitcher length of 11.32±1.61 cm for the ambient. In contrast, the high humid had an average number of 1.98±0.61, with an average pitcher length of 9.36±1.11 cm. Our results indicate a tradeoff between the number and size of pitchers. Specifically, a greater number of pitchers in the high humidity environment corresponded to smaller sizes, while the opposite trend was observed in the ambient environment. Thus, *Nepenthes* plants appear to allocate resources towards either increasing the number or enhancing the size of their pitchers in response to environmental conditions. These findings have the potential to improve cultivation practices for *Nepenthes*, thereby enhancing their overall quality.

Keywords: Humidity, Pitcher size, Carnivorous plants, Hybrid, ventrata

A Study on Efficiency of Dye-sensitized Solar Cells from *Excoecaria cochinchinensis* Lour. Leaf Extract as a Natural Dye

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Dye-sensitized solar cells (DSSCs) offer a promising technology due to their cost-effectiveness and ability to utilize plant pigments as eco-friendly natural dyes. However, the organic nature of plant pigments has been associated with lower power conversion efficiency (PCE). This study aims to explore potential pigment sources and the influence of solvent extracts on enhancing the efficiency and stability of DSSCs. *Excoecaria cochinchinensis* Lour. leaves were selected as a pigment source for integration into the light-absorbing layers of DSSCs. The investigation of pigment properties was conducted in both botany and materials science fields. Epidermal peeling and free-hand leaf cross-section techniques were used to study the accumulation of pigments. *E. cochinchinensis* Lour. leaves were extracted using absolute methanol and dimethyl sulfoxide (DMSO), separately. Light absorption properties and charge separation behaviors of the extracts were examined using UV-visible spectroscopy and surface photovoltage (SPV), respectively. The extracts were further utilized to fabricate prototype DSSC to evaluate PCE and stability. Botanical analysis revealed significant chlorophyll accumulation in the palisade layer of the upper epidermis and anthocyanins in the epidermis and sub-epidermal layers of the lower epidermis of *E. cochinchinensis* Lour. leaves. DMSO extracts exhibited notably higher light absorption compared to methanolic extracts. SPV signals associated with charge separation characteristics were observed at a photon energy of 1.7 eV for methanolic extracts and at a higher photon energy of 2.3 eV for DMSO extracts, indicating broader solar spectrum harvesting by methanolic extracts. Consequently, devices utilizing methanolic extracts demonstrated twice the PCE compared to those using DMSO extracts. In addition, methanolic extract-based devices exhibited better stability, with a 40% reduction in initial PCE compared to a 50% reduction for DMSO extracts after an 8-week aging period without encapsulation. This study offers insights that could facilitate the development of DSSCs using a straightforward and efficient process.

Keywords: Solar cells, Renewable resources, Pigments, Power conversion efficiency

Comparative anatomy of *Pluchea indica* (L.) Less. grown in Rayong and Samut Sakhon

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Pluchea indica (L.) Less., a halophyte shrub, widespread in coastal areas of Thailand, has the potential to be an economic herbal tea. However, the research on its comparative anatomy to the environment is currently absent. The purpose of this research is to compare anatomical characteristics of *P. indica* (L.) Less. from two different soil salinity areas, Samut Sakhon province (ECe 0.10 dS/m) and Rayong province (ECe 2.63 dS/m). The results show that the thickness of the epidermal cells, palisade mesophyll, and spongy mesophyll in *P. indica* leaves from Rayong province is significantly higher than in *P. indica* leaves from Samut Sakhon.The epidermal layer of *P. indica* stems from Rayong also exhibits a thickness higher than that in Samut Sakhon. Additionally, this research reports completely anatomical characteristics in *P. indica* especially its indumentums and salt bladders. This can indicate that *P. indica* has anatomical adaptations due to increasing salinity level. This research provides data that can be used as a database for research about *P. indica* and other halophytes in the future.

Keywords: Comparative anatomy, Halophyte*, Pluchea indica* (L.) Less., Saline soil

Morphology and Anatomy of three *Neptunia* species in Thailand

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The genus *Neptunia* in Thailand is suspected to be *Neptunia oleracea*, *Neptunia plena* and *Neptunia triquetra*. *Neptunia oleracea* is commonly used as a food source and commercial plant, yet *N. plena* and *N. triquetra* are noxious weeds. These three species are unable to be classified by physical appearance. This study investigates the morphological and anatomical characteristics of reproductive and non-reproductive structures to identify the species, using a scanning electron microscope, stereo microscope and light compound microscope. The results showed that *N. plena* and *N. triquetra* have trichomes at leaf margins and ovaries, while it is absent in *N. oleracea*. Pollen grains of *N. oleracea* and *N. plena* are tricolpate-shaped with striate surface. Alternatively, *N. triquetra* is tricolporate-shaped with foveolate surface. In terms of anatomy, *N. oleracea* can be differentiated from *N. plena* and *N. triquetra* by examining the accumulation of substances in the epidermis. Additionally, *N. plena* can be distinguished from *N. oleracea* and *N. triquetra* based on the length of the palisade layer. These obtained results show the difference between the three species which can be used as a baseline for taxonomical applications in *Neptunia*.

Development of Floral Fragrant Gland (Osmophore) in
Alstonia scholaris (L.) R. Br. (Apocynaceae)

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Alstonia scholaris (L.) R. Br. is a large tree with fragrant flowers containing linalool, which has a neuroprotective effect on memory and the thought system. It is frequently used as a component in essential oils to help alleviate anxiety and treat psychiatric disorders or depression. The aim of this research is to study the development of osmophores, identify their location on flowers, and examine their anatomy and micromorphology on flowers from the bud formation to the flowering stage using a light microscope, scanning electron microscope, and stereo microscope. Histochemistry were also tested to identify the main components within the osmophores. Based on flower size, 8 stages of its flower development were identified. Osmophores begin developing at stage 2. The osmophores are spherical in shape and tested positive for Sudan Black B. Oil was found on the surface of the petals, but it was absent at the base of the petals and flower tubes. During the flowering stage, hairs grow sparsely on the petals and many are found at the base of the flowers and flower tubes. Therefore, flowers begin producing osmophores at flower bud stage, which are fully developed and spread mostly around the petals at the blooming stage. Osmophores store mainly oil. The obtained results can serve as a baseline for further observations on extracting an important substance from *Alstonia scholaris* (L.) R. Br. flowers.

Keywords: Osmophore, histochemistry, *Alstonia scholaris* (L.) R. Br., Essential oils, Flower development

Comparing the Efficiency of Vegetable Indices in Predicting Leaf Area Index for Cassava

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Cassava (*Manihot esculenta* Crantz) is a tuberour plant with small shrub and drought resistance. The cultivated area of cassava tends to increase in Thailand. Therefore, the use of satellite imagery data can help in tracking the growth stages of cassava over a larg area. Vegetation indices are values that indicate the proportion of vegetation covering the surface. These indices are calculated by taking the wavelengths related to the vegetation in proportion to each other and can serve as a monitoring tool for the Leaf Area Index (LAI) from the ground. The objective of this research was to compare the performance of 13 vegetation indices by using regression analysis to find the relationship between the vegetation indices and LAI. The results showed that the top three vegetation indices with the highest the coefficient of determination were SeLI, NDWI, GNDVI with Adjusted R^2 values of 0.515, 0.495, 0.495 ($p < 0.001$), respectively. The vegetation indices with the highest positive correlation coefficients were GNDVI, NDVI, and SAVI with R values of 0.71, 0.70, 0.70, respectively. SeLI and NDWI has negative relationships with LAI at R values of -0.73 and -0.71, respectively. Our study showed that SeLI was the most effective vegetation index for further monitoring the growth stages of cassava.

Keywords: Vegetation Indices (VIs), Cassava, Leaf Area Index (LAI), Sentinel-2, Remote Sensing

Anther and Pollinium Development of *Vanda miniata* (Lindl.) L.M.Gardiner

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Vanda miniata (Lindl.) L.M.Gardiner belongs to the genus *Vanda* of Orchidaceae. The *Vanda* species are economically significant plants, which are popularly cultivated and bred for their beautiful hybrids. The development of pollinia in this plant is unique and differs from that of most other flowering plants. The objective of this study was to investigate the anatomy of anther and pollinia development and the deposition of callose walls during pollinia development, using both a light and fluorescence microscope. According to the findings, *V. miniata* pollinia triggers the formation of microspore mother cells. These cells divide to form four microspores in a cluster. The microspore tetrads remain attached until the flowering stage. At the same time, the tapetum layer breaks down normally (after meiosis). Upon testing, we did not observe the formation or dissolution of callose walls, which contrasts with previous reports in other orchids. It is suggested that the tapetum layer in *V. miniat*a, may not be involved in synthesizing callase enzymes, but could play other essential roles, such as producing nutrients to nourish the pollinia or manufacturing coating substances for the pollinia. This report highlights that callose wall formation is absent during pollen development. This information can be used as fundamental knowledge and a model for explaining the development of pollinia in orchids. It can also serve as a basis for further research on *V. miniata*.

Keywords: orchids, economic plants, tapetum, callose wall

Anatomical of *Nymphoides* L. (Menyathaceae) in Thailand and it's taxonomic significant

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The genus *Nymphoides* L. (Menyanthaceae) is an aquatic plant. In Thailand, the anatomical study and the key to species is lacking. The morphological characters are very high variable and also, they have terrestrial and floating leaves. Therefore, we focused on anatomical study of branched, petioles, midrib, leaf margin and leaf surfaces using paraffin technique and peeling methods, respectively. The results showed that the branches and petioles were rounded, elliptic and ovate with a main vascular bundle in the middle and scattered by 6-13 small vascular bundles. The astrosclereids are common except *N. hastata* (Dop) Kerr. The palisade mesophyll consists of 1-2 layer/s and found only in the upper leaf surface. The spongy mesophyll is presented on both leaf surfaces. The margin is acuminate or obtuse. All studied species have raised stomata except *N. hydrophylla* (Lour.) Kuntze and *N.* species4 have typical stomata. The anomocytic stomata was found in all species excepted *N.* species4, which has paracytic stomata. The epidermal cells are jigsaw and polygonal shaped. It is shown that the shape of the branched and petioles, the number and the presence of small vascular bundles, stomatal type, stomatal position and the presence of astrosclereids are useful for support the species identification.

Keywords: Hydrophyte, Medical plant, Ornamental plant, Tropical plant

The Effects of Enshi Nutrient Solution and CO₂ on Above-Ground Growth and Anthocyanin Content in Rhizomes of Black Galingale (Kaempferia parviflora Wall. Ex Baker)

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Black Galingale (*Kaempferia parviflora* Wall. ex Baker) is a medicinal plant that utilizes its rhizomes. However, the challenge of insufficient production to meet market demands is commonly encountered. This research investigated the effects of Enshi nutrient solutions and two levels of CO_2 (400 and 800 ppm) on growth and anthocyanin content. The study revealed that application of Enshi nutrient solution with 800 ppm CO_2 for 3 months had a significant positive impact on growth compared to the control treatment receiving water and 400 ppm CO_2. The dry mass of the plant was 5.35 ± 0.04 g, and the pigment content for chlorophyll A, chlorophyll B, and carotenoids was higher at 1.23 ± 0.20, 0.54 ± 0.07, and 1.45 ± 0.16 mg/L, respectively, compared to other treatments. The SPAD index was 69.10 ± 0.17 units, and the anthocyanin content in the rhizome increased significantly compared to other treatments. At 6 months of age, Black Galingale exhibited an anthocyanin content of 2.19 ± 0.68 mg/L, which subsequently decreased as the rhizome aged and began to decay. The findings from this study indicate that the application of Enshi nutrient solution and 800 ppm CO_2 promotes growth, enhances photosynthesis, and increases anthocyanin synthesis in Black Galingale. Consequently, this technique holds potential for the development of future Black Galingale cultivation systems.

Keywords: *Kaempferia parviflora*; rhizome; photosynthesis; anthocyanin

Preliminary analysis of Thai adults mycobiome with dietary supplement of low-dose copra meal hydrolysate using metaproteomics

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Gut mycobiome plays an essential role in human health, and there is interest in utilizing dietary supplement to modulate the composition and function of fungal communities. Copra meal hydrolysate (CMH) is commonly used as a natural additive to enhance health. However, the gut mycobiome is unknown at taxonomic level and protein functions. In this study, we therefore aimed to analyze, using metaproteomics, the predominant fungal species and protein functions in Thai gut mycobiome after treatment with CMH. The effect of CMH treatment on the Thai gut mycobiome was demonstrated using proteomic technology and basic bioinformatics tools. Accordingly, these results revealed that CMH has potentially effects on the gut mycobiome. Five predominant fungal species e.g., *Wickerhamomyces ciferrii, Agaricus campestris, Monascus ruber, Colletotrichum higginsianum* and *Penicillium brasilianum* as well as their potential protein functions, were involved in immune responses and diseases. These findings suggest that CMH may be used as a potential prebiotic diet for modulating and maintaining the gut mycobiome. To our knowledge, this is the first study to reveal the predominant fungal species and protein functions in the Thai gut mycobiome after treatment with potential prebiotics.

Keywords: Mycobiome; Prebiotics; Copra Meal Hydrolysate; Metaproteomics; Bioinformatics

ปรสิตที่พบในปลาจะละเม็ดขาวจากอ่าวไทยตอนบน
Parasite of Silver pomfret from the upper Gulf of Thailand

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บทคัดย่อ

จากการตรวจปรสิตในปลาจะละเม็ดขาว (*Pampus argenteus*) จากอ่าวไทยตอนบนจำนวน 30 ตัว พบปรสิตทั้งหมด 297 ตัว แบ่งเป็น 4 กลุ่ม จำแนกเป็น 9 ชนิด แบ่งเป็น ปรสิตภายนอก 3 ชนิด ได้แก่ โมโนจีน 1 ชนิด (*Bicotyle stromatea*) และโคพีพอด 2 ชนิด (*Caligus stromatei, Nothobomolochus triceros*) พบบริเวณซี่เหงือก ปรสิตภายใน 6 ชนิด ได้แก่ พยาธิใบไม้ 4 ชนิด (*Genitocotyle mediterranea, Monascus filiformis*, unidentified Bucephalid, unidentified trematode) และพยาธิหนอนตัวกลม 1 ชนิด ได้แก่ unidentified nematode พบในลำไส้ นอกจากนั้นยังพบพยาธิหนอนตัวกลมอีก 1 ชนิดในสกุล *Philometra* บริเวณรังไข่ ในการศึกษาครั้งนี้พบว่า *G. mediterranea* เป็นปรสิตที่มีค่าความชุกชุมสูงที่สุด (ร้อยละ 43.33) รองลงมาได้แก่ *B. stromatea,* unidentified Bucephalid, *M. filiformis,* unidentified trematode, *Philometra* sp., unidentified nematode, *N. triceros* และ *C. stromatei* โดยมีค่าความชุกชุมร้อยละ 33.33, 30.00, 26.67, 13.33, 10.00, 6.67 และ 3.33 ตามลำดับ ความหนาแน่นเฉลี่ยของปรสิตส่วนใหญ่มีค่าระหว่าง 1.00 ถึง 6.00 ตัวต่อปลาที่ติดเชื้อ 1 ตัว ในขณะที่ความหนาแน่นเฉลี่ยของ *G. mediterranea* มีค่าสูงถึง 14.31 ตัวต่อปลาที่ติดเชื้อ 1 ตัว การศึกษานี้รายงานการพบ *G. mediterranea* ในปลาจะละเม็ดขาวเป็นครั้งแรก อย่างไรก็ตาม ปรสิตที่พบในการศึกษาครั้งนี้ยังไม่มีชนิดใดที่ก่อโรคในสัตว์เลี้ยงลูกด้วยนม

คำสำคัญ: ปลาจะละเม็ดขาว; ปรสิต; ความชุกชุม; ความหนาแน่นเฉลี่ย; อ่าวไทย

Abstract

Thirty silver pomfrets (*Pampus argenteus*) from the upper gulf of Thailand were examined for parasitic infection. A total of 297 parasites were found in this study, the parasites divided into 4 groups, consisted of 9 species. Three species of ectoparasites were found at gill filaments namely one species of Monogenean (*Bicotyle stromatea*) and 2 species of copepods (*Caligus stromatei*, *Nothobomolochus triceros*). Six species of endoparasites were identified consisted of four species of trematodes (*Genitocotyle mediterranea*, *Monascus filiformis*, unidentified Bucephalid, unidentified trematode) and unidentified nematode were found in intestine and only one species of *Philometra* sp. was found in ovary. The prevalence of *G. mediterranea* was the highest (43.33%) followed by *B. stromatea*, unidentified Bucephalid, *M. filiformis*, unidentified trematode, *Philometra* sp., unidentified nematode, *N. triceros* and *C. stromatei* with 33.33%, 30.00%, 26.67%, 13.33%, 13.33%, 10.00%, 6.67% and 3.33%, respectively. Mean intensity mostly ranged between 1.00 and 6.00 ind./infected fish while *G. mediterranea* distinguishably represented the highest mean intensity (14.31 ind./infected fish). This study discovered *G. mediterranea* in silver pomfret for the first time. However, there was no species which are pathogenic to mammal.

Keywords: Silver pomfret; Parasite; Prevalence; Mean intensity; the Gulf of Thailand

การเพาะเลี้ยงเนื้อเยื่อและการถ่ายฝากยีนในข้าวฟ่าง

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บทคัดย่อ

ข้าวฟ่าง *Sorghum bicolor* (L.) Moench เป็นธัญพืชที่ปลูกได้ง่าย ทนทานต่อสภาพแห้งแล้งได้ดี นำมาใช้ประโยชน์ได้หลายรูปแบบ เช่น เป็นอาหารของมนุษย์และสัตว์ และยังใช้ผลิตเชื้อเพลิงชีวภาพ ที่สามารถนำมาทดแทนน้ำมันปิโตเลียมได้ ดังนั้นข้าวฟ่างจึงเป็นพืชที่มีความสำคัญและความน่าสนใจในการนำมาศึกษา งานวิจัยฉบับนี้มีจุดประสงค์เพื่อศึกษาเทคนิคการเพาะเลี้ยงเนื้อเยื่อและเพื่อศึกษาการถ่ายฝากยีนในข้าวฟ่าง โดยการเพาะเลี้ยงเนื้อเยื่อเพื่อใช้ในการขยายพันธุ์ข้าวฟ่างจำนวนมากในเวลาอันรวดเร็ว ใช้วิธีการฟอกเมล็ดด้วยแก๊ส แล้วทำความสะอาดต่อด้วยน้ำยาฟอกฆ่าเชื้อ จากนั้นวางเมล็ดลงบนอาหารที่มีการศึกษาแล้วว่าสามารถทำให้เกิดการเจริญเติบโตได้ดีคือ MS media with 2.5 mg/L TDZ, 1.0 mg/L BAP, 0.5 mg/L IAA (pH=5.7) การถ่ายฝากยีนเข้าสู่เนื้อเยื่อใบของข้าวฟ่างโดยใช้ *Agrobacterium tumefaciens* สายพันธุ์ EHA105 โดยมี 2 construct คือ 1. EHA105 *Ruby* 35s P 2. EHA105 *Ruby* Ubi P ซึ่งมี *Ruby* เป็นยีนรายงานผล โดยใช้ความเข้มข้นของเชื้อ OD_{600} = 0.4 จากนั้นวางลงบนสูตรอาหารที่ชักนำให้เกิดแคลลัส พบว่าใบที่ผ่านการถ่ายฝากยีนมีสีดำและใบตายในที่สุด อาจเนื่องจากเวลาถ่ายฝากที่นานเกินไป

คำสำคัญ: *Agrobacterium tumefaciens*, *Ruby* gene, การเพาะเลี้ยงเนื้อเยื่อ, การถ่ายฝากยีน, ข้าวฟ่าง
ตรวจสอบข้อมูล

การศึกษาผลของอาหารเลี้ยงชนิดต่างๆต่อการเจริญเติบโตของแหน (*Lemna aequinoctialis*)
The effects of different media to duckweed (*Lemna aequinoctialis*) growth

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บทคัดย่อ

แหน Lemnaceae เป็นพืชใบเลี้ยงเดี่ยว ขนาดเล็ก อันดับ *Alismatales* ประกอบด้วย 36 ชนิด 5 สกุล *Spirodela, Landoltia, Lemna, Wolffiella* และ *Wolffia* แหนสามารถเติบโตได้ในทั่วโลกทุกเขตภูมิอากาศ ยกเว้นบริเวณขั้วโลก และทะเลทราย มีใบเป็นโครงสร้างพื้นฐานทำหน้าที่ดูดซึมเป็นหลัก มีอัตราการเจริญเติบโตที่สูง Lemnaceae สามารถในการนำไปใช้บำบัดน้ำเสีย เป็นวัตถุดิบที่ดีสำหรับอุตสาหกรรมอาหารสัตว์ และอาหารมนุษย์ นอกจากนั้นแหนสามารถใช้เชื้อเพลิงชีวภาพได้จากปริมาณแป้งที่มีการสะสมไว้ เนื่องจากประโยชน์ในด้านต่าง ๆ ของแหน ทำให้แหนเป็นที่ต้องการมากขึ้นในอุตสาหกรรมต่าง ๆ การศึกษานี้จึงมีจุดมุ่งหมายเพื่อศึกษาอาหารเลี้ยงแหนที่เป็นปัจจัยส่งผลให้แหนมีการเจริญเติบโตที่ต่างกัน เพื่อให้ได้แหนมีเจริญเติบโตได้เร็วและมีคุณภาพ ในการทดลองนี้จะใช้อาหารเลี้ยงแหน 5 ชนิดได้แก่ Hoagland (HL), Modified Hoagland (mHL), Murashige & Skoog (MS), NF และ Shenk and Hidebrandt (SH) เลี้ยงเป็นเวลา 14 วันเพื่อวัดพื้นที่สีเขียว, ความยาวราก, chlorophyll, ประสิทธิภาพการสังเคราะห์แสง, น้ำหนักแห้ง และสกัด RNA สังเคราะห์ cDNA ทำ qPCR เพื่อศึกษา *rbcL* ซึ่งเป็นยีนที่เกี่ยวข้องกับการสังเคราะห์แสงของพืช จากการทดลองผลที่ได้พบว่าในอาหารเลี้ยงแต่ละชนิดมีการเจริญเติบโตของแหนในปริมาณที่ต่างกันโดย NF เป็นอาหารที่แหนมีการงอกของใบ ความยาวรากและพื้นที่สีเขียวเพิ่มขึ้นมาที่สุด และแหนที่เลี้ยงในอาหาร MS มีการแสดงออก four chain ของ *rbcL* มากที่สุด

ความหลากหลายทางพันธุกรรมของสับปะรด
Genetic diversity of pineapple

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บทคัดย่อ

สับปะรด (*Ananas comosus* (L.) Merr) เป็นพืชล้มลุกชนิดหนึ่งที่มีต้นกำเนิดมาจากทวีปอเมริกาใต้ สามารถที่จะเจริญในสภาพแวดล้อมต่างๆ ได้ดี สับปะรดนั้นมีหลากหลายสายพันธุ์ และสายพันธุ์ต่างๆ ก็มีลักษณะที่แตกต่างกันออกไป งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาความหลากหลายทางพันธุกรรมของสับปะรดที่ปลูกในประเทศไทย 10 สายพันธุ์ ได้แก่ นางแล, ภูชวา, ภูเก็ต, ตราดสีทอง, ปัตตาเวีย, T16, T17, 40, MD-2 และ CO-2 โดยใช้เครื่องหมาย start codon targeted polymorphism (SCoT) จำนวน 34 ไพรเมอร์ พบว่ามีแถบดีเอ็นเอที่เพิ่มปริมาณได้ทั้งหมด 203 แถบ เฉลี่ย 5.97 แถบต่อไพรเมอร์ มีแถบที่แสดงความแตกต่าง 146 แถบ คิดเป็น 71.89% เฉลี่ย 4.29 แถบต่อไพรเมอร์ และมีค่า polymorphic information content (PIC) เฉลี่ย 0.14 การวิเคราะห์ความคล้ายคลึงทางพันธุกรรม ด้วยวิธี simple matching ได้ค่า similarity coefficient เฉลี่ยอยู่ที่ 0.94 ซึ่งแสดงว่าสับปะรดทั้ง 10 สายพันธุ์นี้มีพันธุกรรมที่ใกล้เคียงกัน

คำสำคัญ: สับปะรด, pineapple, *Ananas comosus*, start codon targeted polymorphism, SCoT marker

การเก็บรักษา Turion ของแหน *Spirodela polyrhiza*
Cryopreservation of turion *Spirodela polyrhiza*

ข้อมูลนิสิตผู้ทำโครงงาน
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บทคัดย่อ

    Spirodela polyrhiza ซึ่งเป็นหนึ่งในวงศ์ Lemnaceae เป็นพืชน้ำขนาดเล็กที่ลอยน้ำได้อย่างอิสระ มีปริมาณโปรตีนและคาร์โบไฮเดรตสูง สามารถเจริญเติบโตได้อย่างรวดเร็วในรุ่นหนึ่ง โดยใช้เวลาประมาณ 2–5 วัน turion เป็นใบพิเศษของ *Spirodela polyrhiza* มีโครงสร้างที่ใช้สะสมอาหารสำหรับการเจริญเติบโตของพืช มีบทบาทสำคัญในกลยุทธ์การอยู่รอดของ *Spirodela polyrhiza* การก่อตัวของ turion *Spirodela polyrhiza* เกิดขึ้นได้จากการขาดสารอาหาร สภาวะไม่เหมาะสมของสิ่งแวดล้อม อุณหภูมิของน้ำ และสารเคมี การทำ cryopreservation คือการเก็บรักษาเซลล์ด้วยความเย็น ถือเป็นวิธีที่มีประสิทธิภาพสูงสุดสำหรับการเก็บรักษาของเชื้อพันธุกรรมพืชในระยะยาว โดยการทดลองทำการสุ่มตัวอย่าง turion จากการเพาะเลี้ยง นำมาทำ cryopreservation แบ่งออกเป็น 2 แบบ 1. cryo-plate 2. cryo-drop แบบที่ 1. นำ turion ลงไปใน cryo-plate แล้วหยด sodium alginate ลงไปใน plate แล้วนำไปแช่ใน calcium chloride 15 นาที แบบที่ 2 นำ turion ลงไปใน sodium alginate แล้วหยดลง calcium chloride 15 นาที หลังจากนั้นนำไปแช่ใน LS solution 90 นาที, แช่ PVS2 solution 90 นาที นำ turion ใส่หลอด 15 mL เก็บในไนโตรเจนเหลว, -20℃, 4℃ , 25℃ จากนั้นนำมา unloading ใน 1 M sucrose 15 นาที regrowth ศึกษาอัตราการงอก 14 วัน ผลการเจริญเติบโตของ turion ได้สำเร็จหลังจากการเก็บรักษาด้วยการแช่เย็น cryopreservation เอา turion ที่งอกแล้ว มาวัดการเรืองแสงของคลอโรฟิลล์ โดยใช้เทคนิค pulse-amplitude-modulated (PAM) เพื่อดูการสังเคราะห์แสง เปรียบเทียบกับ control turion แสดงให้เห็นถึงการสังเคราะห์แสงสามารถฟื้นตัวได้ หลังจาก day7 ไปถึง day14 มีค่าใกล้เคียงกับ control เพื่อดูการแสดงของของยีนที่เกี่ยวข้องกับการสังเคราะห์แสง จึงสกัด RNA สังเคราะห์ cDNA ออกแบบ primer โดยใช้ primer3 สำหรับการทำ qPCR เพื่อศึกษาดูการแสดงออกของยีน *rbcL* แต่เนื่องจากอัตราการงอกของ turion น้อยเกินไปไม่สามารถนำมาสกัด RNA ได้ จึงได้สกัด RNA กับตัว control คือ *Spirodela polyrhiza* day0 แทน วิธีการทำ cryopreservation นี้ เป็นวิธีการเก็บรักษาสภาพเซลล์ โดยการใช้การแช่แข็ง ใช้ความเย็น เพื่อจัดเก็บเชื้อพันธุ์ของแหน ช่วยลดการใช้แรงงานในการเพาะปลูก และรักษาลักษณะตัวอย่างพันธุ์พืชได้ในอนาคต

<div align="right">ผศ.ดร.พีรภัฏ รุ่งสัทธรรม</div>

การพัฒนาเครื่องหมายที่จำเพาะต่อลักษณะหนามในสับปะรด
Developing specific marker to thornless phenotype in *Ananas comosus* (L.) Merr

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ประสิทธิภาพในการผลิตสับปะรดส่วนหนึ่งเกี่ยวข้องกับการเก็บเกี่ยว ใบที่มีหนามของสับปะรดเป็น อุปสรรคอย่างหนึ่งที่ทำให้การเก็บเกี่ยวผลผลิตทำได้ช้า การปรับปรุงพันธุ์สับปะรดให้ได้พันธุ์ที่ไม่มีหนามที่ ขอบใบจึงน่าจะช่วยให้การเก็บเกี่ยวทำได้ง่ายขึ้น การพัฒนาเครื่องหมายดีเอ็นเอที่มีความจำเพาะต่อลักษณะที่มี หนามและไม่มีหนามจะช่วยให้การคัดเลือกในกระบวนการปรับปรุงพันธุ์มีประสิทธิภาพมากขึ้น ดังนั้น การศึกษา นี้จึงมีวัตถุประสงค์เพื่อพัฒนาเครื่องหมายดีเอ็นเอที่จำเพาะต่อลักษณะไม่มีหนามที่ขอบใบในสับปะรด โดย ทดสอบไพรเมอร์ที่ออกแบบจากบริเวณ single nucleotide polymorphism (SNP) บนโครโมโซมที่ 23 จำนวน 31 คู่ไพรเมอร์ในสับปะรดพันธุ์ภูเก็ต (มีหนาม) และพันธุ์ CO-2 (ไม่มีหนาม) จากผลการทดลองพบว่ามี เพียง 1 คู่ไพรเมอร์ (22-SNP7-d-F1/R0) ที่มีแนวโน้มใช้แยกความแตกต่างระหว่างพันธุ์ภูเก็ตและพันธุ์ CO-2 ได้ หากปรับสภาวะของ PCR ให้เหมาะสม และตรวจสอบความจำเพาะของคู่ไพรเมอร์นี้ต่อลักษณะการมีหนาม หรือไม่มีหนามที่ขอบใบในสับปะรดสายพันธุ์อื่นๆ ต่อไป

คำสำคัญ: สับปะรด, pineapple, *Ananas comosus* (L.) Merr, allele-specific PCR

Specific gene expression levels of *Plasmodium vivax* in sporozoites stage

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Malaria is a life-threatening infectious disease caused by the *Plasmodium* parasite, which is transmitted to humans through female mosquitoes of the *Anopheles* genus. In this study, we investigated the expression levels of ten specific genes of *Plasmodium vivax* in sporozoite stage: *Sporozoite surface protein essential for liver stage development* (SPELD), *Liver stage associated protein 1* (LSAP1), *Phosphatidylcholine-sterol acyltransferase* (PL), *Gamete egress and Sporozoite traversal protein* (GEST), *Sporozoite protein essential for cell traversal* (SPECT1), *Heat shock protein 90* (HSP90), *Small heat shock protein, Protein UIS3* (UIS3), *Sporozoite invasion-associated protein 1* (SIAP1), *and Bax inhibitor 1*, which are genes involved in the development and cell traversal of *Plasmodium* parasites in the human liver, traversal proteins, and common proteins of *Plasmodium* parasites using qRT-PCR. The results showed that the expression levels of these ten specific genes in the sporozoite stage vary based on the quantity of *P. vivax*. The quantity of *P. vivax* is directly correlated with gene expression levels; a higher quantity of *P. vivax* induces higher gene expression levels. These findings offer valuable insights into the regulation of gene expression and its potential role in controlling malaria transmission and advancing malaria research.

Keywords: Gene expression, *Plasmodium vivax,* sporozoites, qRT-PCR

Effects of carbon (coconut endosperm residue) to nitrogen (soybean curd residue) ratio on the nutritive values of black soldier fly larvae (*Hermetia illucens*)

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Black soldier fly (BSF, *Hermetia illucens*) larvae are proficient in metabolizing organic waste, yielding valuable protein and fat resources sustainably, which is a source of raw materials for many types of economic animal feed. Moreover, it can also be utilized to produce high-value products such as antioxidants, cosmetics, and biodiesel. This research aims to study the effects of carbon (coconut endosperm residue: C) to nitrogen (soybean curd residue: N) ratio that is appropriate for the nutritional value of BSF larvae. Seventeen distinct C:N ratios were examined with three replicates each, ensuring in larvae is the same age and similar in weight. When it was found that there were only one pre-pupa larvae in each experimental group, the recipe experiment in that replicate was immediately terminated. Results revealed that the chemical composition of BSF larvae, when fed with a 0:100 C:N ratio showed the highest total protein content at 45.1%. Conversely, a C:N ratio of 100:0 yielded the highest total fat content at 59.5%, both statistically significant ($P < 0.001$) compared to other ratios. This is consistent with the chemical composition of the food fed to larvae. When increasing the amount of protein and total fat in the food will cause the chemical composition of BSF larvae to increase. This results in the production of BSF larvae that has a good nutritional value and quality. These findings suggest the potential for cultivating BSF larvae commercially as an alternative source of protein and fat for animal feed applications. Furthermore, this approach presents a sustainable means of mitigating organic waste, contributing to environmental preservation endeavors.

Keywords: black soldier fly larvae, nutritive values, organic waste, soybean curd residue, coconut endosperm residue

**Effect of fraction from Sung Yod Rice (Oryza sativa L.)
on breast cancer cell progression**

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Breast cancer is the most common tumor in women and leading cause of female cancer associated mortality worldwide. Although treatment methods for breast cancer have significantly advanced, such as radiation therapy and chemotherapy, reducing mortality rates, but these treatments often have substantial impacts on the patient's body. Previous studies have shown the ability of crude extract from Sung Yod Rice (Oryza sativa L.) to inhibit the proliferation and migration of breast cancer cells, specifically the MCF-7 cell line. In this research, crude extracts were analyzed using HPLC, revealing a high concentration of phenolic compounds, with ferulic acid being the most abundant. Methods cell migration was assessed by Wound healing assay, MCF-7 breast cancer calls were cultured in media containing ferulic acid at concentrations of 0, 1.0, 2.0, and 4.0 mM for 48 hours. The results showed that ferulic acid at concentrations of 2.0 and 4.0 mM significantly reduced the migratory ability of MCF-7 breast cancer cell. The data suggest that ferulic acid may be a key compound in reducing the migration of MCF-7 breast cancer cells. This study provides valuable information for the development of extraction techniques for bioactive compounds from Sung Yod Rice (Oryza sativa L.) for future medical applications.

Keywords: MCF-7 breast cancer cells; Sung Yod Rice extract; Wound healing assay; progression and migration; Concentration of rice extract

Identification of circular RNA responsible for luminal A progression

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Luminal A breast cancer has been frequently found in patients. Although basic therapies have advanced in the present, the rate of death among patients still highly increases each year. Hence, studying the mechanism of breast cancer development to develop new methods for treating breast cancer is extremely necessary. Many previous studies have shown that circular RNA (circRNA) plays a critical role in controlling the aggressiveness of breast cancer and can be targeted for treatment in the future. In this study, the researcher identified a circRNA, miRNA, and protein interaction network to develop breast cancer. Microarray data were collected from the Gene Expression Omnibus (GEO) database with miRNA interactome analysis. The circRNAs with the highest expression levels in luminal A breast cancer cells compared to normal tissue cells are hsa_circRNA_101004, hsa_circRNA_104800, hsa_circRNA_104653, hsa_circRNA_100685, and hsa_circRNA_103345. Five circRNAs were identified: circRNA, miRNA, and protein networking. Moreover, 19 hub genes were extracted from the PPI network, which is important for gene pathway control and responding to luminal A progression. In addition to the results of gene enrichment analysis and Reactome, these controlled proteins are associated with cellular responses to stress, the intrinsic pathway for apoptosis, the activation of BH3-only proteins, and pre-NOTCH expression and processing that affected luminal A progression. These results indicate that five circRNAs could be biomarkers for breast cancer diagnosis and target therapy development in the future.

Keywords: Circular RNA, Breast cancer, luminal A, miRNA interaction, network analysis

Antimicrobial activity of *Curcuma phrayawan* (Zingiberaceae) essential oil against zoonotic and foodborne pathogens

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Phaya Wan (*Curcuma phrayawan* Boonma & Saensouk) is a plant in the family Zingiberaceae. It is often grown in the home gardens as a medicinal plant or according to Thai-ancient beliefs. This plant species has been recorded as a new species and a new record in Thailand in 2021. The biological activities and the chemical composition of this species have not yet been officially reported. Therefore, the objective of this study was to investigate the antimicrobial activity of *Curcuma phrayawan* essential oil against zoonotic and foodborne pathogens. Additionally, the study aimed to examine the basic components of *C. phrayawan* essential oil. We found that the percentage yield of *C. phrayawan* essential oil obtained through steam distillation from 3 kg of dried weight was 0.208. The antimicrobial activities against eight microorganisms; *Staphylococcus aureus, Bacillus cereus, Salmonella typhimurium, Escherichia coli, Pseudomonas aeruginosa, Candida* sp.*, Aspergillus* sp.*,* and *Penicillium* sp. by using a broth dilution method were performed with concentrations ranging from 37.5 to 300 mg/mL. These findings revealed that *C. phrayawan* essential oil effectively inhibited the growth of various microorganisms. Notably, this essential oil exhibited the highest inhibitory activities against *S. aureus, B. cereus* and *E. coli* with the minimum inhibitory concentration (MIC value = 75 mg/mL). For *Candida* sp.*, Aspergillus* sp.*,* and *Penicillium* sp. were moderately inhibited (MIC value = 150 mg/mL). Interestingly, *Candida* sp. was demonstrated to be the highest susceptibility to *C. phrayawan* essential oil, with a minimum lethal concentration (MLC value = 150 mg/mL), followed by *S. aureus* (MLC value = 300 mg/mL). These results indicated that *C. phrayawan* essential oil presented antimicrobial activity against a range of pathogenic microorganisms. The results of chemical analysis of this essential oil showed that the volatile compounds were terpenes. However, the further analysis of the chemical composition is required and the modes of action in antimicrobial activities of each microorganism reported above need to be clarified.

Keywords: *Curcuma phrayawan*; essential oil; Antimicrobial activity; zoonotic; foodborne

Neuroprotective effects of beta-sitosterol against brain white matter damage in mice with cerebral Ischemia-reperfusion injury

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Stroke is one of the major causes of death worldwide. Insufficient blood delivery to the brain leads to neuronal and white matter damages and leads to disability and death of stroke patients. Therefore, the prevention of damage to the nervous system from stroke is of utmost importance. This study aimed to evaluate the effect of beta-sitosterol (B-sit) on delaying of white matter damage in mice with cerebral ischemia-reperfusion (IR) injury. Forty-male ICR mice were randomly divided into four groups: Sham-veh, IR-veh, IR-B-sit50, and IR-B-sit100. All treatments i.e., normal saline as vehicle solution (veh) and B-sit 50 mg/kg and 100 mg/kg were orally given to mice for 1 week before IR induction. All IR groups were received IR induction including 30 minutes bilateral common carotid artery occlusion followed by a 45 minutes of reperfusion. Subsequently, brains were collected for evaluation of white matter pathology in corpus callosum (CC), internal capsule (IC), and optic tract (Opt.) using 0.1% luxol fast blue staining. The results showed that IR significantly decreased all area white matter density comparing IR-veh to Sham-veh ($p < 0.05$). Both doses of B-sit exhibited the significant protective effect on white matter density reduction induced by IR when compared B-sit groups to IR-veh ($p < 0.05$). We concluded that beta-sitosterol processes the neuroprotective effect against IR induced white matter damage in mice.

Keywords: Beta-sitosterol; Ischemia-reperfusion; White Matter Injury; Corpus callosum; Internal capsule; Optic tract

ผลของไทโรซอลต่อพยาธิสภาพของสมองส่วนฮิปโปแคมปัสในหนูไมซ์ที่มีภาวะสมองขาดเลือดชั่วคราว
Effect of tyrosol on hippocampal neuronal pathology in mice with ischemia-reperfusion injury

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บทคัดย่อ

ภาวะสมองขาดเลือดชั่วคราว (Cerebral ischemia reperfusion; IR) พบได้ในโรคหลอดเลือดสมองมีความเกี่ยวข้องกับการตายของเซลล์และเส้นประสาทสมองนำมาซึ่งความผิดปกติของระบบประสาทอย่างถาวร ดังนั้นการศึกษาในครั้งนี้จึงวัตถุประสงค์เพื่อศึกษาผลของไทโรซอลต่อพยาธิสภาพของเซลล์ประสาทสมองบริเวณฮิปโปแคมปัสในหนูไมซ์ที่ถูกเหนี่ยวนำให้เกิดภาวะสมองขาดเลือดชั่วคราว โดยใช้หนูไมซ์เพศผู้สายพันธุ์ ICR จำนวน40ตัว จะถูกแบ่งออกเป็น 4 กลุ่ม ได้แก่ Sham-veh , IR-veh , IR-Tyr50 และ IR-Tyr100 โดยจะป้อนสารละลายทางปากให้กับหนูในแต่ละกลุ่มการทดลอง ได้แก่ น้ำเกลือ ไทโรซอล ปริมาณ 50 และ 100 mg/kg เป็นเวลา 1 สัปดาห์ ก่อนทำการผ่าตัดผูกหลอดเลือดแดงคอมมอนคาโรติดทั้งสองข้างเป็นเวลา 30 นาที และปล่อยให้เลือดไหลย้อนกลับ 45 นาที ยกเว้นหนูในกลุ่ม Sham-veh ที่ไม่ได้รับการผ่าตัดผูกหลอดเลือด เมื่อสิ้นสุดระยะเวลาจะมีการเปลี่ยนแปลงพยาธิสภาพระดับเนื้อเยื่อในสมองส่วนฮิปโปแคมปัสโดยใช้การย้อมสีด้วย 0.1%cresyl violet จากนั้นนำมาประเมินผล ผลการศึกษาพบว่า ทั้ง3บริเวณไม่มีความแตกต่างอย่างมีนัยสำคัญ (p > 0.05) ในกลุ่มIR อย่างไรก็ตามเมื่อพิจารณาโดย total cell และ viable cell พบว่ามีเพียงตำแหน่ง Dentate gyrus ที่มีความแตกต่างอย่างมีนัยสำคัญ (p < 0.05) เมื่อเปรียบเทียบระหว่าง Sham-veh และ IR-veh ดังนั้นการศึกษาผลของไทโรซอลต่อพยาธิสภาพของเซลล์ประสาทสมองบริเวณฮิปโปแคมปัสพบว่าการรักษาด้วยไทโรซอลมีแนวโน้มที่จะป้องกันการลดลงของ viable cell และ total intact cell ในสมองส่วนฮิปโปแคมปัส

คำสำคัญ: ไทโรซอล; ภาวะสมองขาดเลือดชั่วคราว; พยาธิสภาพ; ฮิปโปแคมปัส; เดนเตตไจรัส

Abstract

Cerebral ischemia-reperfusion (IR) injury as found in stroke is associated with cell death and neuronal loss leading to permanent nervous system disorders. The present study aimed to evaluate the effects of tyrosol (Tyr) on hippocampal neuronal pathology in mice with cerebral IR injury. Forty-male ICR mice were randomly divided into four groups: Sham-veh, IR-veh, IR-Tyr50, and IR-Tyr100. Mice in each experimental group received oral administration of either normal saline (veh) or tyrosol at doses of 50 mg/kg and 100 mg/kg for one week before inducing cerebral IR injury. The IR injury was induced by 30 minutes of bilateral common carotid artery occlusion followed by 45 minutes of reperfusion. The Sham-veh group received only surgery without arterial occlusion. Histopathological changes in the hippocampus were evaluated using 0.1% cresyl violet staining. Results showed no significant differences of percentage of degenerating cell in all three regions ($p > 0.05$). However, when considering total intact cell and especially viable cell, it was found that only the dentate gyrus had a significant difference ($p < 0.05$) when comparing Sham-veh and IR-veh. Treatment with tyrosol tend to prevent the reduction of viable and total intact cell in the hippocampus.

Keywords: Tyrosol; Cerebral ischemia reperfusion; Pathology; Hippocampal; Dentate gyrus

ผลของไทโรซอลต่อพยาธิสภาพของเส้นใยประสาทสมองในหนูไมซ์ที่มีภาวะสมองขาดเลือดชั่วคราว
Effect of tyrosol on white matter pathology in mice with cerebral ischemia reperfusion injury

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บทคัดย่อ

ภาวะสมองขาดเลือดชั่วคราว Cerebral ischemia-reperfusion (IR) เป็นหนึ่งในสาเหตุสำคัญในการเสียชีวิตและความพิการทั่วโลก โดยการเสื่อมลงของพยาธิสภาพนำไปสู่ความเสียหายของเซลล์ประสาทและ white matter damage การศึกษาในนี้มีวัตถุประสงค์เพื่อศึกษาผลของสารไทโรซอลต่อพยาธิสภาพของเส้นใยประสาทในหนูไมซ์ที่ถูกเหนี่ยวนำให้เกิดภาวะสมองขาดเลือดชั่วคราว หนูไมซ์ (ICR) เพศผู้ 40 ตัว สุ่มแบ่งเป็น 4 กลุ่ม ดังนี้ (1) Sham-veh (ได้รับเฉพาะน้ำเกลือ), (2) IR-veh (ได้รับเฉพาะน้ำเกลือ), (3) IR-Tyr50 (ได้รับไทโรซอล 50 มก./กก.) และ (4) IR-Tyr100 (ได้รับไทโรซอล 100 มก./กก.) ทำการป้อนสารทางปากต่อเนื่องเป็นเวลา 1 สัปดาห์ หนูในกลุ่ม IR จะได้รับการผูกหลอดเลือดแดงคอมมอนคาโรติดนาน 30 นาที และปล่อยให้เลือดไหลย้อนกลับ 45 นาที บริเวณสมองที่นำมาประเมินการเปลี่ยนแปลงทางพยาธิวิทยาของใยประสาทคือ คอร์ปัส คาโลซัม (CC), อินเทอร์นอล แคปซูล (IC) และออพติคแทร็ก (Opt.) โดยย้อมด้วย luxol fast blue ผลการวิจัยพบว่าความหนาแน่นของใยประสาทในกลุ่มของ IR มีการลดลงอย่างมีนัยสำคัญทุกบริเวณ เมื่อเปรียบเทียบ IR-veh กับ Sham-veh (p< 0.05) การรักษาล่วงหน้าหนึ่งสัปดาห์ด้วยไทโรซอล 50 มก./กก. และ 100 มก./กก. แสดงให้เห็นการป้องกันการเสื่อมสภาพของใยประสาทอย่างมีนัยสำคัญในบริเวณ CC, IC และ Opt. เมื่อเปรียบเทียบกับ IR-veh (p<0.05) ดังนั้น การศึกษานี้จึงชี้ให้เห็นถึงผลการป้องกันระบบประสาทของไทโรซอลต่อความเสียหายของใยประสาทที่เกิดจากภาวะสมองขาดเลือดชั่วคราวในหนูได้

คำสำคัญ: : ความเสียหายของใยประสาท; ไทโรซอล; คอร์ปัส คาโลซัม; อินเทอร์นอล แคปซูล; ออพติคแทร็ก

Abstract

Cerebral ischemia-reperfusion (IR) is one of the leading causes of death and disability globally with deteriorated pathomechanism led to neuronal and white matter damage. This study aimed to investigate the effect of tyrosol on white matter pathology in mice with cerebral ischemia reperfusion injury. Forty-male ICR mice were randomly divided into 4 groups as follows: (1) Sham-veh (received only normal saline), (2) IR-veh (receive only normal saline), (3) IR-Tyr50 (received tyrosol 50 mg/kg) and (4) IR-Tyr100 (receive tyrosol 100 mg/kg). All treatments were given orally and continued for 1 week. Mice in IR groups were subjected to IR surgery which was induced by 30-min bilateral common carotid artery occlusion followed by 45-min reperfusion. Brains were collected for evaluation of white matter pathological changes in corpus callosum (CC), internal capsule (IC) and optic tract (Opt.) using luxol fast blue staining. The result showed that IR significantly induced the reduction of white matter in all areas of interest when compared IR-veh to Sham-veh (p< 0.05). One-week pretreatment with tyrosol 50 mg/kg and 100 mg/kg showed a significant protective effect against CC, IC and Opt. white matter damages when compared to IR-veh (p<0.05). Therefore, this study depicted the neuroprotective effect of tyrosol against IR injury-induced white matter damage in mice.

Keywords: White matter damage; Tyrosol; Corpus callosum; Internal capsule; Optic tract

Effective extract of fungal-fermented mangosteen peel on normal and antibiotic-resistant *Cutibacterium acnes*

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Cutibacterium acnes (*C. acnes*) is associated with the skin disorder acne vulgaris. Misuse of antibiotics results in the emergence of drug-resistant variations of *C. acnes*. Discovering new antibiotics is significantly important in the effective treatment of acne. This research aims to extract substances from mangosteen peels with and without fungal fermentation and examine the antibiotic activity of the extracts against antibiotic-sensitive and resistant isolates of *C. acnes*. The minimal inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of fungal-fermented and non-fermented mangosteen peel extracts against the antibiotic-sensitive and resistant isolates of *C. acnes* have been reported. For testing against normal *C. acnes*, the results show no difference between normal and fungal-fermented mangosteen peel extracts, as both exhibit MIC and MBC values of 50 µg/ml and 100 µg/ml, respectively. Both extracts have the same MIC value of 50 µg/ml against drug-resistant *C. acnes*. However, the normal mangosteen peel extracts have an MBC of 100 µg/ml, while fungal-fermented mangosteen peel extracts have an MBC of 400 µg/ml against resistant isolates of *C. acnes*. A molecular examination is being performed to determine the proteome differences of *C. acnes* after receiving both extracts. This research demonstrates the effectiveness of mangosteen peel extracts in inhibiting drug-resistant *C. acnes*, suggesting further molecular analysis of these extracts to identify the active compounds.

Keywords: *Cutibacterium acnes*, mangosteen peel extract, minimal inhibitory concentration, minimum bactericidal concentration, antibacterial activity

ผลของไทโรซอลต่อสภาวะเครียดออกซิเดชันในสมองของหนูไมซ์ที่มีภาวะสมองขาดเลือดชั่วคราว
Effect of tyrosol on brain oxidative stratus in mice with cerebral ischemia reperfusion injury.

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บทคัดย่อ

ภาวะสมองขาดเลือดชั่วคราว (IR) เป็นหนึ่งในสาเหตุหลักของโรคทางระบบประสาท ที่เกี่ยวข้องกับความเสียหายจากการขาดเลือด และ การบาดเจ็บจากการไหลกลับของเลือด เนื่องจากมีการเพิ่มปริมาณการเกิดสารอนุมูลอิสระส่งผลให้เกิดความเสียหายต่อเซลล์ประสาทเกิดขึ้น การศึกษาในครั้งนี้ได้ศึกษาถึงผลของสารไทโรซอล (Tyr) ในภาวะที่เลือดไปเลี้ยงสมองลดลงจากการผูกหลอดเลือดแดงคอมมอนคาโรติดชั่วคราว โดยใช้หนูเพศผู้สายพันธุ์ ICR เป็นจำนวน 40 ตัว สุ่มแบ่งกลุ่มเป็น Sham-veh , IR-veh , IR-Tyr50 , IR-Tyr100 กลุ่ม vehicle (veh) ได้รับน้ำเกลือ และ กลุ่ม Tyr ได้ให้สารไทโรซอล 50 และ 100 มก./กก. การรักษาทั้งหมดถูกให้ทางปาก และทำต่อเนื่องเป็นเวลา 1 สัปดาห์ ก่อนกระตุ้น IR ด้วยการผูกหลอดเลือดคอมมอนคาโรติด ทั้งสองข้าง เป็นเวลา 30 นาที หลังจากนั้นปล่อยให้เลือดไหลกลับ 45 นาที หลังจากนั้น ค่าความเครียดออกซิเดชันในสมองถูกวิเคราะห์โดยใช้วิธีการตรวจสี เช่น การประเมินมาลอนไดอัลดีไฮด์(MDA), ปริมาณเอนไซม์คาตาเลส (CAT), ปริมาณกลูตาไธโอน (GSH), ปริมาณเอมไซม์ซุปเปอร์ออกไซด์ดิสมิวเทส (SOD) ผลลัพธ์แสดงให้เห็นว่าไม่มีการเปลี่ยนแปลงที่สถานะออกซิเดชันในสมองที่เกิดขึ้นจากการกระตุ้น IR เมื่อเปรียบเทียบกับ IR-veh กับ Sham-veh (p > 0.05) ผลลัพธ์ที่เหมือนกันก็ปรากฏในหนูที่ได้รับการรักษาด้วยไทโรซอล ไม่มีความแตกต่างที่สำคัญเมื่อเปรียบเทียบกับ IR-Tyr50 และ IR-Tyr100 กับ IR-veh หรือ Sham-veh (p > 0.05) ดังนั้น ผลของไทโรซอลต่อสภาวะความเครียดออกซิเดชันในสมองของหนูที่มีภาวะสมองขาดเลือดชั่วคราวไม่ชัดเจน เนื่องจาก IR ไม่มีผลต่อพยาธิสภาพ

คำสำคัญ: ไทโรซอล; ภาวะสมองขาดเลือดชั่วคราว; ความเครียดออกซิเดชัน; สารต้านอนุมูลอิสระ; เซลล์ประสาท

Abstract

Cerebral ischemia reperfusion (IR) injury is one of the major cause of neurological disorders. IR pathological mechanism is associated with ischemic damage followed by reperfusion injury due to an increase of free radical formation and lead to the damage of neural tissue. This study investigated effect of tyrosol (Tyr) on brain oxidative stratus in mice with cerebral ischemia reperfusion injury. Forty-male ICR mice were randomly divided into Sham-veh, IR-veh, IR-Tyr50, IR-Tyr100 groups. Mice in vehicle (veh) groups received normal saline solution and Tyr groups received tyrosol 50 mg/kg and 100 mg/kg. All treatments were orally given and continue for 1 week before IR induction. IR was induced by 30 minutes bilateral common carotid artery occlusion followed by 45 minutes of reperfusion. Thereafter, brain oxidative status was analyzed using colorimetric method i.e., evaluation of malondialdehyde (MDA), catalase enzyme (CAT), glutathione (GSH), superoxide dismutase (SOD). The results indicated no significant change of brain oxidative status induced by IR induction when compared IR-veh to Sham-veh (p > 0.05). Similar results also presented in mice treated with tyrosol. There was no significant difference when compared IR-Tyr50 and IR-Tyr100 to either IR-veh or Sham-veh (p > 0.05). Therefore, the effect of tyrosol on brain oxidative stratus in mice with cerebral IR injury is not clear due to IR does not reach the pathological condition.

Keywords: tyrosol; transient ischemic attack; oxidative stress; antioxidants; nerve cell

Effects of lipid-extraction methods on the nutritional profiles and *in vitro* digestibility of black soldier fly larvae (*Hermetia illucens*) by-products as protein source for monogastric terrestrial animals

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Black soldier fly larvae (BSFL, *Hermetia illucens*) are highly efficient in digesting organic waste and converting it into a high-value source of protein and fat, which can be utilized in the production of various economic animal feeds. Additionally, they have demonstrated capabilities in the production of antimicrobial substances, cosmetics, biodiesel, and other valuable products. The fat extraction industry, aimed at producing oil from BSFL, is actively seeking methods to extract large quantities of BSFL fat while maintaining the quality of the protein in the larvae. It is crucial that the extraction process does not compromise the nutritional integrity of the protein, ensuring that animals consuming BSFL with extracted fat can still digest the protein effectively. This approach is beneficial for producing high-quality protein raw materials to be utilized in the animal feed production industry. Thus, the aim of this study was to investigate the impact of different fat extraction methods on the quality of BSFL post-extraction, with a focus on chemical composition and in vitro digestibility, simulating the digestive systems of monogastric animals such as broilers, swines, and dogs. Samples from BSFL subjected to six distinct fat extraction methods were analyzed. Results from the study of extracting fat from larvae using ultrasonic extraction with ether revealed that the highest protein content was 45.05%, which showed a significant difference ($P < 0.05$) compared to other methods. For fat extraction using ultrasonic extraction with hexene, it was found that the percentage of protein digestibility in chickens was the highest, followed by pigs and dogs, at 81.36%, 71.22%, and 69.13%, respectively. These results indicate that fat extraction using ultrasonic extraction with ether leads to higher protein nutritional quality. Additionally, fat extraction using ultrasonic extraction with hexene demonstrates superiority over other *in vitro* digestion methods.

Keywords: black soldier fly larvae; oil extraction methods; nutritive values; *in vitro* digestibility; animal feed

ชนิดและการกระจายของตัวอ่อนปูในระยะ zoea บริเวณปากแม่น้ำแม่กลอง จังหวัดสมุทรสงคราม
Species and Distribution of Crab Zoea at Mae Klong River Mouth, Samut Songkhram Province.

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บทคัดย่อ

ศึกษาความหลากของขนิดและการกระจายของตัวอ่อนปูในลุ่มน้ำแม่กลองจังหวัดสมุทรสงคราม ระหว่างเดือนมีนาคมถึงเดือนพฤษจิกายน โดยใช้ถุงแพลงค์ตอนขนาดตา 330 ไมครอน เก็บตัวอย่างใน 14 สถานี แต่ละสถานีมีพื้นที่ครอบคลุมตั้งแต่อำเภอบางคนที ถึงบริเวณปากแม่น้ำที่ดอนหอยหลอดอำเภอเมือง พบตัวอ่อนปูทั้งหมด 9 สกุล และตัวอ่อนปูที่พบมีพัฒนาการตั้งแต่ระยะ Zoea 1 ถึง Zoea 3 ซึ่งจะมีความหลากหลายในพื้นที่ศึกษาที่เป็นน้ำเค็ม โดยสกุล Grapsidae, Anomura และ Ocypodidae เป็นสกุลเด่น จากการศึกษาพบความสัมพันธ์ที่เด่นชัดระหว่างความหนาแน่นของตัวอ่อนปูกับความเค็มของพื้นที่ศึกษา ผลของการศึกษาพบว่า โดยในเดือนเมษายน เป็นเดือนที่พบความหนาแน่นของตัวอ่อนปูสูงที่สุด โดยพบหนาแน่นที่บริเวณสถานีที่ 8 พบความหนาแน่น 24200 ตัว/10 m^3 ตัวอ่อนปูสกุล Grapsidae มีความหนาแน่นสูงที่สุดและพบได้ในทุกเดือนที่ทำการศึกษา ในขณะที่พื้นที่ศึกษาบริเวณปากแม่น้ำแม่กลองมีความหลากชนิดของตัวอ่อนปูมากที่สุด

คำสำคัญ: ตัวอ่อนปู; Brachyura; แพลงค์ตอน; ลุ่มน้ำแม่กลอง; สมุทรสงคราม

Abstract

A study of crab larvae diversity in Maeklong Estuary, Samut Songkram, was investigated from March to November 2023 using 330 µm plankton net in 14 stations. The spatial sampling was performed in 14 stations, from upstream in Bang Khonthi District to the river mouth at Don Hoi Lot. A total of nine families were found. All crabs were Zoea stage 1 to stage 3. The crab larvae were diverse in salt water, and Grapsidae, Anomuna, and Ocypodidae were the dominant groups. There was a significant relationship between the density of zooplankton and the salinity of seawater. The results from this study indicated that the most abundant of crab larvae were found in station 8 of April had an average of 24200 In/10 m^3. Grapsidae was the most abundant, found in almost all study sites. While the study sites in the mouth of Mae Klong River were found to be the most diverse of crab larvae.

Keywords: Crab larva; Brachyura; plankton; Meaklong estuary; Samut Songkram

Preliminary comparative analysis of Thai adults mycobiome with dietary supplement between high- and low-dose copra meal hydrolysate using metaproteomics

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Gut mycobiome plays a key role in human health. It is a great interest in utilizing dietary supplement to modulate the composition of mycobiome. As previous report, a dosage of copra meal hydrolysate (CMH) might be affected on mycobiome modulation in human health. However, the gut mycobiome is unknown at taxonomic level. In this study, we therefore aimed to analyze and compare the predominant fungal species in Thai gut mycobiome after treatment with high- and low-dose CMH using metaproteomics and basic bioinformatics tools. As a result, the dosage of CMH treatment was affected on the fungal species in the human gut. Accordingly, three predominant fungal species identified from high-dose CMH e.g., *Naumovozyma castellii*, *Penicillium decumbens* and *Epichloe uncinated*, whereas five predominant fungal species identified from low-dose CMH e.g., *Wickerhamomyces ciferrii, Agaricus campestris, Monascus ruber, Colletotrichum higginsianum* and *Penicillium brasilianum*. These findings show that the dosage of CMH was influence on the fungal community in Thai human gut after treatment with dietary supplement by prebiotics.

Keywords: Mycobiome; Prebiotics; High-dose copra meal hydrolysate; Metaproteomics; Bioinformatics

ผลของเบต้า-ซิโตสเตอรอลต่อสภาวะเครียดออกซิเดชันในสมองของหนูไมซ์ที่มีภาวะสมองขาดเลือดชั่วคราวEffect of beta-sitosterol on brain oxidative stress in mice with cerebral ischemia reperfusion

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บทคัดย่อ

โรคหลอดเลือดสมองเป็นสภาวะการขาดเลือดไปยังบริเวณสมองบางส่วนเนื่องจากการอุดตันของหลอดเลือดแดง อาจทำให้เกิดความเสียหายต่อเซลล์ประสาทได้ทั้งในภาวะขณะที่ขาดเลือดและขณะการไหลกลับของเลือด (Ischemia reperfusion; IR) ภาวะผิดปกตินี้ส่งผลต่อระบบประสาทเกี่ยวกับความสัมพันธ์การเพิ่มขึ้นของสารต้านอนุมูลอิสระ การศึกษาในครั้งนี้ได้ศึกษาผลของสารเบต้า-ซิโตสเตอรอลต่อการต้านภาวะเครียดออกซิเดชันในสมองหนูไมซ์ที่เกิดภาวะสมองขาดเลือดแบบชั่วคราว โดยใช้หนูเพศผู้สายพันธุ์ ICR เป็นจำนวน 40 ตัว จะถูกแบ่งออกเป็น 4 กลุ่ม คือ Sham-veh, IR-veh, IR-Bss50 และ IR-Bss100 หนูแต่ละกลุ่มทดลองถูกป้อนสารละลายผ่านทางปาก ซึ่งได้แก่ น้ำเกลือ เบต้าซิโตสเตอรอล ปริมาณ 50 และ 100 mg/kg เป็นระยะเวลา 1 สัปดาห์ก่อนทำการผ่าตัดผูกหลอดเลือดแดงคอมมอนคาโรติด ทั้ง 2 ข้าง เป็นระยะเวลา 30 นาที และทำการปล่อยให้เลือดไหลเวียนกลับอีกครั้งเป็นระยะเวลา 45 นาทีจากนั้นนำเนื้อเยื่อสมองมาตรวจสอบสถานะออกซิเดชันโดยทำการศึกษาปริมาณโปรตีน, catalase (CAT), reduced glutathione (GSH), superoxide dismutase (SOD) และ malondialdehyde (MDA) โดยใช้วิธีการวิเคราะห์ทางชีวเคมี ผลการทดลองพบว่า IR ไม่สามารถทำให้เกิดการเปลี่ยนแปลงอย่างมีนัยสำคัญโดยระบุจาก MDA, GSH, CAT และ SOD (p > 0.05) อย่างไรก็ตามการรักษาด้วย BSS ปริมาณ 50 mg/kg แสดงให้เห็นถึงการเพิ่มขึ้นอย่างมีนัยสำคัญของ GSH และ CAT จึงสรุปได้ว่าการเหนี่ยวนำของ IR นั้นไม่ส่งผลมากพอที่จะทำให้เกิดการเปลี่ยนแปลงของภาวะเครียดออกซิเดชัน ในขณะที่การรักษาด้วย BSS มีแนวโน้มที่จะเพิ่มกิจกรรมของ GSH และ CAT ในสมองของหนูที่มีอาการบาดเจ็บจาก IR ในสมอง

คำสำคัญ: เบต้า-ซิโตสเตอรอล; สารต้านอนุมูลอิสระ; ภาวะเครียดออกซิเดชั่น; ภาวะสมองขาดเลือดชั่วคราว; หลอดเลือดแดงคอมมอนคาโรติด

Abstract

Stroke is a neurological condition resulting from the lack of blood flow to specific brain regions due to blockage of arteries. This condition led to neuronal damage induced by delayed ischemia reperfusion (IR) injury accordance with the increase of oxidative stress. The present study aimed to investigate the effect of beta-sitosterol (Bss) on brain oxidative stress in mice with cerebral IR injury. Forty-male ICR mice were randomly divided into 4 groups: Sham-veh, IR-veh, IR-Bss50, and IR-Bss100. Mice were orally administered with normal saline solution (veh) or Bss 50 mg/kg and 100 mg/kg for 1 week before IR surgery. Cerebral IR injury was induced by 30 minutes of bilateral common carotid artery occlusion followed by 45 minutes of reperfusion. Brain oxidative status was evaluated using colorimetric method i.e., total protein level, malondialdehyde (MDA), reduced glutathione (GSH), superoxide dismutase (SOD) and catalase (CAT) activities. Results showed that IR did not induce a significant changes of brain oxidative status indicated by MDA, GSH, CAT and SOD (p > 0.05). However, treatment with Bss 50 mg/kg showed enhancing effect on GSH and CAT activity. We concluded that IR induction not severe enough to induced changes of brain oxidative status, while treatment with beta-sitosterol tend to enhance the GSH and CAT activity in mice brain with cerebral IR injury.

Keywords: Beta-sitosterol; Antioxidant; Oxidative stress; Ischemia reperfusion; Common carotid

ผลของสารไทโรซอลต่อพยาธิสภาพของเซลล์ประสาทบริเวณคอร์เท็กซ์และสไตรเอตัมในหนูไมซ์
ที่เกิดภาวะสมองขาดเลือดชั่วคราว

Effect of tyrosol on cortical and striatal neuronal pathology in mice with ischemia-reperfusion injury

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บทคัดย่อ

ไทโรซอล (Tyrosol; Tyr) เป็นสารที่มีคุณสมบัติในการต้านอนุมูลอิสระจากน้ำมันมะกอกดังนั้นจึงนำสารไทโรซอลซึ่ง เป็นโภชนบำบัดและเป็นสารบำบัดเพื่อป้องกันมาศึกษาผลต่อการต้านการเสื่อมของเซลล์ประสาทเมื่อเกิดภาวะสมองขาดเลือด (ischemia reperfusion-IR) การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาผลของสารไทโรซอลต่อพยาธิสภาพของเซลล์สมองบริเวณ คอร์เท็กซ์ (CT) และสไตรเอตัม (ST) ในหนูไมซ์ที่ถูกเหนี่ยวนำให้เกิดภาวะสมองขาดเลือดชั่วคราว หนูไมซ์ (ICR) เพศผู้ จำนวน 40ตัว สุ่มแบ่งออกเป็น 4 กลุ่ม ได้แก่ Sham-veh, IR-veh, IR-Tyr50 และ IR-Tyr100 โดยหนูในกลุ่ม veh จะได้รับน้ำเกลือโดย การป้อนทางปาก และหนูในกลุ่ม Tyr ได้รับไทโรซอลปริมาณ 50 และ 100 มก./กก ตามลำดับ โดยให้สารเป็นเวลา 1 สัปดาห์ จากนั้นทำการผ่าตัดผูกหลอดเลือดคอมมอนคาโรติดทั้งสองข้างเป็นเวลา 30 นาที แล้วปล่อยให้เลือดไหลย้อนกลับเป็นเวลา 45 นาทีในกลุ่ม IR-veh, IR-Tyr50, IR-Tyr100 ในขณะที่กลุ่ม Sham-Veh ได้รับการผ่าตัดโดยไม่ได้มีการผูกหลอดเลือด ทำการศึกษาพยาธิสภาพของเซลล์ประสาทบริเวณCTและST โดยการย้อมด้วย 0.1% Cresyl violet ผลการศึกษาพบว่ามีการ ลดลงอย่างมีนัยสำคัญเฉพาะในเซลล์ประสาท ST เมื่อเทียบกับกลุ่ม Sham-veh แต่ไม่เป็นเช่นนั้นในเซลล์ประสาท CT เมื่อ เทียบกับกลุ่ม Sham-veh (p < 0.05) นอกจากนี้ยังมีการเพิ่มขึ้นอย่างมีนัยสำคัญของเซลล์ประสาท ST ใน IR-Tyr50 เมื่อเทียบ กับ IR-veh (p < 0.05) การศึกษาครั้งนี้ชี้ให้เห็นถึงผลของไทโรซอลต่อเซลล์ประสาทในส่วนของ CT ไม่ชัดเจน แต่สำหรับ ST ไท โรซอลที่มีปริมาณ 50 มก./กก มีผลดีในหนูที่ถูกเหนี่ยวนำให้เกิดภาวะสมองขาดเลือดชั่วคราว

คำสำคัญ: สไตรเอตัม; คอร์เท็กซ์; ไทโรซอล; ภาวะสมองขาดเลือดชั่วคราว; พยาธิสภาพ

Abstract

Tyrosol is an active ingredient deliver from olive oil and it possess potent antioxidant properties. Therefore, it is interesting using of tyrosol as nutraceutical and preventive therapy. The present study aimed to evaluate the effects of tyrosol on cortical (CT) and striatal (ST) neuronal pathology in mice with cerebral ischemia-reperfusion (IR) injury. Forty-male ICR mice were randomly divided into four groups: Sham-veh, IR-veh, IR-Tyr50, and IR-Tyr100. Normal saline was used as vehicle (veh) treatment and tyrosol 50 mg/kg and 100 mg/kg were given to mice in Tyr groups and continue for one week before inducing cerebral IR injury. The IR injury was induced by 30 minutes of bilateral common carotid artery occlusion followed by reperfusion for 45 minutes. Histopathology of CT and ST were evaluated using 0.1% cresyl violet staining. Results showed a significant reduction only in ST neurons but not CT neurons when compared IR-veh to the Sham-veh group (p < 0.05). There was a significant increase in ST neurons in IR-Tyr50 when compared to IR-veh (p < 0.05). The present study suggested that the neuroprotective effects of tyrosol on CT neurons is unclear but ST neurons tyrosol exhibits an effective dose as 50 mg/kg in mice with cerebral IR injury.

Keywords: Striatal; Cortical; Tyrosol; Cerebral ischemia reperfusion; Pathology

Effect of tyrosol on brain infarction in mice with ischemia-reperfusion injury

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Cerebral ischemia-reperfusion (IR) injury resulting from lack of cerebral blood perfusion can lead to alteration of neuronal function and structure. Pathogenic mechanism of IR including oxidative stress and inflammation play the major role in neuronal necrosis and apoptosis. Nowadays nutraceuticals are on focus and may be benefit against disease onset and progression including neurodegenerative disease. Tyrosol (tyr) is a phenolic ingredient deliver from olive oil, vermouth, and some types of beer. It processes anti-oxidation and anti-inflammation properties. Therefore, the present study investigated the neuroprotective effect of tyrosol against cerebral IR injury in mice. Forty-male ICR mice were divided into 4 groups; Sham-veh, IR-veh, IR-tyr50 and IR-tyr100 groups. Vehicle (veh; normal saline) or tyrosol were given to mice for 7 consecutive days before IR induction surgery. IR was induced by 30 minutes common carotid artery occlusion following by 45 minutes of reperfusion in IR groups. Brains were collected for infarction evaluation using 2 % TTC staining. The results showed no significant of brain infarction induced by IR and treatment with tyrosol also insignificant difference. We concluded that the neuroprotective effect of tyrosol was not clearly depicted due to IR does not severe to a significant pathological induction.

Keywords: Ischemia-reperfusion injury, Tyrosol, Neurodegeneration disease, Brain infarction, Neuroprotective

Diversity and Abundance of Zooplankton in Mae Klong Estuary, Samut Songkhram Province.

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A study of the diversity and abundance of zooplankton in Mae Klong Estuary, Samut Songkhram Province, was investigated from April to November 2023 using plankton nets in 14 stations. The spatial sampling was performed in 14 stations, from upstream in Bang Khonthi District to the river mouth at Don Hoi Lot. A total of four phyla and seventeen orders were found. The dominant group was copepods, of which 23 species were found. Copepods were more diverse in the saline water. The dominant and common species was *Pseudodiaptomus clevi*. The copepod density, diversity, and abundance were significantly correlated with salinity. Copepod diversity was highest in April, and station 12.2 was the most diverse, with the Shannon-Wiener Diversity Index and Evenness index of 1.77 and 0.57, respectively. Copepod density was highest in August, and station 12.1 with the density of 1.55×10^6 individual/10 m^3.

Keywords: Copepod, Salinity, Zooplankton, Mae Klong estuary, Samut Songkhram Province

ผลของเบตานินต่อพยาธิสภาพของสมองในหนูที่มีการเหนี่ยวนำให้เกิดการเสื่อมของระบบประสาทด้วยสารไตรเมทิลติน
Effect of Betanin on Brain Pathology in Mice with Trimethyltin-induced Neurodegeneration.

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บทคัดย่อ

การได้รับสารพิษจากสิ่งแวดล้อมเป็นหนึ่งในปัจจัยหลักที่ทำให้เกิดโรคการเสื่อมของระบบประสาท สารไตรเมทิลติน (TMT) เป็นหนึ่งในสารประกอบดีบุกอินทรีย์ ที่ใช้เป็นส่วนประกอบของยาฆ่าแมลง สารกำจัดศัตรูพืช และสารตั้งต้นในการผลิตพลาสติก PVC ความเป็นพิษของสารไตรเมทิลตินส่งผลให้เกิดความเสียหายต่อเนื้อเยื่อประสาทและนำไปสู่ความผิดปกติทางระบบประสาท ในการศึกษานี้ เพื่อประเมินผลของเบตานินต่อพยาธิสภาพของสมองหนูที่มีการเหนี่ยวนำให้เกิดการเสื่อมของระบบประสาทด้วยสารไตรเมทิลติน หนูไมซ์เพศผู้ จำนวน 30 ตัว สุ่มแบ่งเป็น 5 กลุ่ม ได้แก่ Sham-Veh, TMTL, TMTH, TMTL+bet100 และ TMTH+bet100 ในกลุ่ม TMT สารไตรเมทิลตินความเข้มข้นต่ำ (L = 1 มก./กก.) และสารไตรเมทิลตินความเข้มข้นสูง (H = 2.6 มก./กก.) ถูกฉีดเข้าที่ช่องท้อง 1 ครั้ง และป้อนสารเบตานินที่ความเข้มข้น 100 มก./กก. ทางปาก เป็นเวลา 3 สัปดาห์ จากนั้นทำการเก็บตัวอย่างสมองเพื่อนำไปวิเคราะห์จุลพยาธิวิทยา ผลการศึกษาแสดงให้เห็นว่าไม่มีความแตกต่างอย่างมีนัยสำคัญระหว่างจำนวนเซลล์เป็นและเซลล์ตายในสมองส่วน Cortex และ Hippocampus รวมถึง White matter อย่าง Corpus callosum และ Optic tract ในทุกกลุ่ม ($p > 0.05$) การให้สารเบตานินความเข้มข้น 100 มก./กก. ยังไม่แสดงให้เห็นความแตกต่างอย่างมีนัยสำคัญ เมื่อเทียบกับกลุ่ม Sham-Veh หรือ กลุ่ม TMT ($p > 0.05$) จึงสรุปได้ว่าสารไตรเมทิลตินทั้งความเข้มข้นต่ำและความเข้มข้นสูงไม่ทำให้มีการเปลี่ยนแปลงอย่างมีนัยสำคัญต่อพยาธิสภาพของเซลล์ประสาทและใยประสาทสมอง ทำให้ผลต่อระบบประสาทของสารเบตานินไม่ชัดเจนในการศึกษานี้

คำสำคัญ: ระบบประสาทเสื่อม; สารไตรเมทิลติน; เบตานิน; พยาธิสภาพของสมองหนู; ความเป็นพิษ

Abstract

Environmental toxin exposure is one of major risk factor for further causing of neurodegenerative disease. Trimethyltin (TMT) is one of major organotin compound used as pesticides, antifoulant paint and PVC plastic stabilizer. TMT toxicity including neuronal tissue damage and leading to neurological disorder. This study aimed to evaluate the effect of betanin on brain pathology in mice with trimethyltin-induced neurodegeneration. Thirty-male ICR mice were randomly divided into 5 groups: Sham-Veh, TMTL, TMTH, TMTL+bet100 and TMTH+bet100. In TMT groups, TMT low-dose (L = 1 mg/kg) and high-dose (H = 2.6 mg/kg) were one-time injection and orally treated with betanin 100 mg/kg was given to bet groups for 3 weeks. After that brains were collected for histopathology evaluation. The results showed no significant difference of dead and viable cells in cortex and hippocampus as well as white matter i.e., corpus callosum and optic tract in all groups ($p > 0.05$). Treatment with betanin 100 mg/kg also showed no significant difference either comparing with Sham-veh or TMT treated groups ($p > 0.05$). We concluded that TMT both low and high dose did not induce a significant change in brain neuronal and white matter pathology, these led to an unclear neuroprotective effect of betanin in the present study.

Keywords: Neurodegeneration; Trimethyltin; Betanin; Mice brain pathology; Toxicity

Comparison effect of beta-sitosterol and tyrosol on pancreatic beta-cells in mice

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Diabetes is one of majors metabolic disease in which the body has glucose homeostasis alteration. Pancreatic beta-cell plays importance role in glycemic control by the producing and releasing of insulin. Nowadays, the use of bioactive compound delivered from phytonutrients to nurturing cells and body functions is on focus. Therefore, the present study aimed to investigate the nurturing effects of beta-sitosterol (Bss) and tyrosol (Tyr) on pancreatic beta-cell in mice. Twenty-five male ICR mice were randomly divided into Sham (oral administration with 10% Tween 80), Tyr50 (oral administration with tyrosol 50 mg/kg), Tyr100 (oral administration with tyrosol 100 mg/kg), Bss50 (oral administration with beta-sitosterol 50 mg/kg) and Bss100 (oral administration with beta-sitosterol 100 mg/kg). After one-week oral administration, pancreatic tissues were collected and histological evaluations were done with H&E staining and anti-insulin Immunohistochemistry. The results showed that only beta-sitosterol dose 100 mg/kg significantly increased the number of islets ($p < 0.05$). Both doses of beta-sitosterol and only tyrosol 50 mg/kg significantly increased islet area when compared to Sham ($p < 0.05$). Both beta-sitosterol and tyrosol showed no effect on beta-cell area or the percentage of beta-cell indicated by anti-insulin immunoreactivity ($p > 0.05$). The present study concluded that beta-sitosterol tend to have a greater nurturing effect on pancreatic islets than tyrosol in normal mice.

Keywords: Beta-cell, Pancreas, Beta-sitosterol, Tyrosol, ICR-mice

Species diversity and habitat utilization of anuran at
Taksin Maharat National Park, Tak Province

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The present study on species diversity and habitat utilization of anuran at Taksin Maharat National Park. Was conducted between October 2022 to April 2023, with visual encounter survey method. Seven families, belonging to seventeen genera and twenty-eight species were discovered in four different types of forest, which are Hill Evergreen Forest, Mixed Deciduous Forest, Deciduous Dipterocarp Forest and Teak Plantation. The most common species was *Leptobrachium smithi*. Four anurans species have been recorded in this area for the first time: *Alcalus cf. tasanae*, *Limnonectes taylor*i, *Odorrana chloronota*, and *Brachytarsophrys carinense*. In terms of habitat utilization, Mixed Deciduous Forest had the highest values for the Shannon diversity index (2.75), followed by Deciduous dipterocarp forest (2.63), Hill Evergreen Forest (2.28), and Teak plantation (1.03), respectively. Possible that the area with various microhabitats and low disturbance is suitable for amphibians in this area.

Keywords: Anurans diversity; Taksin Maharat National Park; Diversity index

การระบุเมแทบอลิกยีนและวิถีที่เกี่ยวข้องของ *Hermetia illucens* ด้วยข้อมูลเชิงจีโนม
Annotation of Metabolic Genes and Associated Pathways of *Hermetia illucens* using Genomics Data

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บทคัดย่อ

Hermetia illucens เป็นหนึ่งในแมลงวันลายที่มีศักยภาพที่ถูกนำมาใช้ในระดับอุตสาหกรรมได้ อันเนื่องมาจากความสามารถในการเปลี่ยนของเสียทางชีวภาพให้กลายเป็นสารชีวโมเลกุลที่มีคุณค่าทางเศรษฐกิจ นอกจากการนำมาใช้เป็นแหล่งโปรตีนทางเลือกแล้วนั้น *H. illucens* ก็ยังเป็นแหล่งไขมันที่ยั่งยืน โดยเฉพาะการสังเคราะห์กรดไขมันในระยะตัวอ่อนเพื่อนำมาใช้เป็นแหล่งพลังงานสำหรับระยะตัวเต็มวัย ข้อมูลดังกล่าวบ่งบอกถึงวิถีของการสังเคราะห์กรดไขมันของ *H. illucens* การศึกษาวิถีดังกล่าวด้วยข้อมูลจีโนมควบคู่กับการระบุหน้าที่ยีนสามารถใช้ศึกษาลักษณะของวิถีทางเมแทบอลิซึมในสิ่งมีชีวิตได้ ดังนั้นงานวิจัยนี้ได้ทำการระบุหน้าที่และแสดงผลของเมแทบอลิกยีนจากจีโนมของ *H. illucens* สายพันธุ์ KUP เมื่อพิจารณาการวิเคราะห์ชุดยีนที่มีความสัมพันธ์ใกล้ชิดเชิงวิวัฒนาการกัน ผลที่ได้รับพบว่าจำนวนชุดของยีนหลายชุดที่มีความเกี่ยวข้องกับการย่อยสลายแป้งไปสู่การสังเคราะห์กรดไขมันและลิปิด เช่น alpha-amylase, fatty acid synthase, acetyl-CoA carboxylase, และ acyl-CoA synthetase นอกจากนั้นยังพบชุดของยีน alpha-amylase ที่ถูกจัดอยู่ในกลุ่มเดียวกันกับ *Amyrel* ซึ่งอาจสามารถนำมาใช้เป็นยีนเป้าหมายในการศึกษาการปรับตัวทางสรีรวิทยาของ *H. illucens* และการนำไปประยุกต์ใช้กับอุตสาหกรรมเทคโนโลยีชีวภาพต่อไป

คำสำคัญ: จีโนมิกส์; แมลงวันลาย; การระบุหน้าที่ยีน; การสังเคราะห์กรดไขมันและลิปิด; ชีวสารสนเทศ

Abstract

Hermetia illucens is one of the potential insect species to be industrialized given its ability in food bioconversion, which can be used to convert biodegradable waste into valuable products. Aside from acting as alternative source of protein, *H. illucens* is also a sustainable source of lipid, especially fatty acids which are shown to be rapidly synthesized during its larval stage to be utilized on adult stage. This implies an advancement of de novo fatty acid biosynthesis pathway to be investigated for further utilizations of *H. illucens*. This can be achieved through the availability of genomic data coupled with the development of functional annotation tools which can be used to predict the characteristics of metabolic pathways in organisms. This study aimed to perform functional annotation of metabolic genes in the *H. illucens* KUP genome. Accordingly, overall metabolic genes and functions of *H. illucens* KUP were identified. Considering orthologous gene sets analysis, observably multiple copies of gene sets e.g., alpha-amylase, fatty acid synthases, acetyl-CoA carboxylase, and acyl-CoA synthetase were identified to be associated in starch degradation towards fatty acid and lipid biosynthesis. Interestingly, a high copy of alpha-amylase genes set paralogue *Amyrel* present in *H. illucens* KUP which may serve as a potential target for further investigation of the unique physiological adaptation in *H. illucens* with ultimate goals for the industrial biotechnology.

Keywords: Genomics; *Hermetia illucens*; Functional gene annotation; Fatty acid and lipid biosynthesis; Bioinformatics

Impact of using industrial by products of sesame meal residue, soybean curd residue and coconut endosperm residue on the growth performances efficiency of digestion and absorption of food into of black soldier fly larva (*Hermitia illucens*)

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Black soldier fly larvae (BSFL, *Hermetia illucens*) are economically valuable animals with numerous benefits. Additionally, they have the capability to convert products from the agricultural industry into valuable biomass, serving as a source of protein and lipid in feed for various economically significant animals such as fish, ducks, chickens, pigs, etc. Furthermore, BSFL are highly efficient in decomposing organic waste, making them an environmentally sustainable solution. Therefore, this research has the objective to find the ratio of industrial by-products of sesame meal residue (Se). soybean curd residue (S) and coconut endosperm residue (C) as a supplementary food for raising the BSFL for efficient growth. Efficiency of digestion and absorption of food into biomass of BSFL. Seven-day-old BSFL were fed a mixture of (Se), (S), and (C) in six different ratios, with three replicates, ensuring that larvae were of the same age and similar in weight. When it was found that there was only one pre-pupa larvae in each experimental group, the recipe experiment in that replicate was immediately terminated. Results of the experiment revealed that the BSFL fed (S)50:(Se)0 formula had the highest growth rate and food reduction rate of 1.08 and 5.95 g/day, respectively, with a highly significant difference ($p < 0.001$). The highest digestion and absorption efficiency was found in the (S)0:(Se)50 formula at 0.46, which was not significantly different from other formulas ($p > 0.05$). The nutritional content of Se, S, and C as sources of lipid, protein, and energy directly impacts growth performance. Enhancing the efficiency of digestion and absorption of food into biomass of BSFL increases their value and can also contribute to expanding the agricultural industry.

Keywords: black soldier fly larvae; growth; sesame meal residue; soybean curd residue; coconut endosperm residue; organic waste

Protein Content and Profile of Reticulated Python (*Malayopython reticulatus*) Meat

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Animal meat protein is an essential nutrient for the human body. Currently, only proteins from fish, chicken, pork, and beef are commonly consumed. However, the meat protein information of snake, particularly Reticulated python (*Malayopython reticulatus*), has not been reported. This study, the reticulated python meats that attached with skin were collected from a farm in Uttaradit Province. The samples were cleaned, freeze – dried and extracted using an extraction solution (1% SDS, 0.1 M DTT, and 60 mM Tris – HCl at pH 7.5) with comparison with fish and pork extracts. The python meat extracts were analyzed through protein quantification, and electrophoresis (SDS – PAGE). The results demonstrated significant differences in protein quantities among the python, fish, and pork meats ($p< 0.05$), with average values of 4.67, 3.81, and 4.17 mg/ml, respectively. Furthermore, the electrophoresis on 10% separated gel presented the 7 python meat protein bands with main protein bands as 45.54 and 37.85 kDa. These bands were identified as myofibrillar proteins (actin and tropomyosin, respectively), But, fish and pork extracts protein patterns revealed 17 and 15 protein bands, respectively. Remarkably, the python meat lacked myosin as a major protein band, unlike in fish and pork. These findings indicate differences in both the quantity and pattern of proteins extracted, which may due to the diverse movement patterns of animal muscles, affecting the molecular weights of myofibrillar proteins. These results provides crucial preliminary information about cultivated reticulated python meat, supporting its value and potential future application in the food and medical industries.

Keywords: Reticulated python (*Malayopython reticulatus*); Protein; Protein content; Protein profile; SDS – PAGE

Chemical Composition of Reticulated Python (*Malayopython reticulatus*) Oil

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Nowadays, the skin of the Reticulated Python (*Malayopython reticulatus*) is mainly used in leather industry, leaving other parts as waste requiring disposal costs. Among these parts, fat remains. This study aimed to extract oil from python fat obtained from a snake farm in Uttaradit using two methods: rendering and pressing. It then utilized vacuum filtration to isolate the most unsaturated fats. The fatty acid composition was measured using gas chromatography for analysis and comparison among methods. Results showed the %Yield of 41% for Rendering and 18.8% for Pressing, with no significant impact of extraction methods on the quantity of fatty acid composition. The analysis identified Omega 3 (α-Linolenic acid, Eicosapentaenoic acid, Docosahexaenoic acid), Omega 6 (γ-Linolenic acid, Eicosadienoic acid, Eicosatrienoic acid, Arachidonic acid), and Omega 9 (Oleic acid) as the fatty acids with the highest quantities in Python oil. In conclusion, this research provides basic data that can serve as a starting point to further transform waste raw materials into added value and helps reduce the cost of fat removal.

Keywords: *Malayopython reticulatus*; Python oil; Fatty acid profiles; Fatty acid;
Oil extraction

Diversity and habitat utilization of reptiles at Taksin Maharat National Park, Tak province.

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This study provides the diversity of reptiles and their utilization of habitats in Taksin Maharat National Park, Tak province. The data were recorded 16 nights from October 2022 to November 2023, through a visual encounter survey method. A total of six routes, covering four main habitat types as follows: 1) evergreen hill forest, 2) mixed deciduous forest, 3) deciduous dipterocarp forest, and 4) teak plantation. A total of 93 individuals from 2 Orders 10 families 16 genera 21 reptile species were found in this study. As a result, the number of reptile species in this area was updated from 45 to 56. The most common species across all habitat types is *Sphenomorphus maculatus* that are well-suited to survive in a variety of environments. The heterogeneity of habitats and the level of disturbance by humans are the main factors that affect the diversity of reptiles in the study area. The evergreen hill forests show the highest reptile diversity (H' = 2.40), particularly with low human disturbance, as the forest remains intact. According to cluster analysis, reptiles in evergreen hill forests were most similar to deciduous dipterocarp forests. Then, mixed deciduous forests formed another cluster. Those three types of forest consist mostly of leaf litter and have low disturbance which affects the outcome of similar species composition. On the other hand, teak plantations are open forest ecosystems with high levels of disturbance resulting in the lowest reptile diversity (H' = 1.28). Only distinct reptile species that are adapted to modified habitats were found in this locality.

Keywords: Heterogeneity of Habitats; Reptiles; Species Diversity; Taksin Maharat National Park; Visual encounter survey method

Acceptability of a dried top-up powder for cats by using black soldier fly larvae (*Hermetia illucens*) as protein replacement for tuna

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As a result of the COVID situation, more people are owning cats nowadays. Therefore, there is a growing interest among pet owners in providing healthy and innovative products. As a result, incorporating insects into pet food or treats has emerged as a strategy to attract pet owners who are seeking novel and nutritious options for their pets. The black soldier fly larvae (BSFL, *Hermetia illucens*) can be used as a protein substitute because high nutritional value. This study aimed to determine the acceptability of a dried top-up powder for cats by using BSFL as protein replacement for tuna at different levels (100, 50 and 0%). 23 adult cats with no clinical symptoms tested by using the One-bowl Acceptability test (Double blinded randomized crossover design) for 9 days. Mix the powder in cat food each formula test 3 days, 1 meal per day in a row. Collect results with forms and video recordings. Found that each formula had no relationship with food acceptance ($P > 0.05$), the acceptance rates were 47.69, 52.38, and 65.15%, respectively. However, an increase of levels of BSFL in formula would decrease the acceptability of the powder. This has the same effect on the amount of food that cat consumes. Behavioural, there is an expression of interest in food. It can be concluded that cat acceptance tends to decreasing on formulas that uses protein from BSFL quantity increases. However, further studies should be done on other product formats, developing formulas, or using other techniques to increase acceptance.

ผลกระทบของวิธีการสกัดน้ำมันจากหนอนแมลงวันลาย (*Hermetia illucens*) ต่อปริมาณและคุณภาพของกรดไขมัน
The effects of fat extraction methods from black solider fly larvae(*Hermetia illucens*) on quantity and quality of fatty acids

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บทคัดย่อ

การศึกษาตัวอ่อนหนอนแมลงวันลาย (*Hermetia illucens*) ซึ่งเป็นแหล่งชีวโมเลกุลที่มีคุณค่าและมีความสำคัญใน อุตสาหกรรมเภสัชและเครื่องสำอาง เนื่องจากองค์ประกอบทางเคมีในตัวอ่อนหนอนแมลงวันลายมีปริมาณโปรตีน แร่ธาตุ และ ไขมันสูง การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาผลกระทบจากวิธีการการสกัดน้ำมันจากหนอนแมลงวันลายต่อปริมาณและ องค์ประกอบของกรดไขมัน โดยแบ่งวิธีการสกัดน้ำมันออกเป็น 5 วิธีประกอบด้วย Hotplate stirrer 45 ℃, Hotplate stirrer 65 ℃, Hotplate stirrer 95 ℃, Hexane, และ Microwave ผลการศึกษาพบว่า การสกัดน้ำมันด้วย Ultrasonic รวมกับ Hexane ให้ปริมาณน้ำมันสูงที่สุดรองลงมา คือ Hotplate stirrer 95 ℃, Hotplate stirrer 65 ℃, Hotplate stirrer 45 ℃ และ Microwave การวิเคราะห์ปริมาณกรดไขมันของน้ำมันจากหนอนแมลงวันลายที่สกัดด้วยวิธีที่แตกต่างกันพบว่ามีปริมาณ ของกรดไขมัน กรดลอริกสูงที่สุดรองลงมาคือ กรดปาล์มมิติก, กรดไมริสติก และกรดสเตียริก เมื่อเปรียบเทียบปริมาณกรดไขมัน จากวิธีการสกัดแบบต่างๆพบว่า การสกัดน้ำมันด้วยวิธี Hotplate stirrer 65 ℃ เป็นวิธีการสกัดที่เหมาะสมสำหรับการสกัด น้ำมันจากหนอนแมลงวันลาย เนื่องจากมีองค์ประกอบของกรดลอริกมาก ซึ่งมีความสามารถในการต้านอนุมูลอิสระ และ สามารถพัฒนาต่อไปเป็นวัสดุชีวภาพที่ใช้ในอุตสหกรรมเภสัชและเครื่องสำอางได้อย่างยั่งยืน

คำสำคัญ: หนอนแมลงวันลาย; วิธีการสกัดน้ำมัน; กรดไขมัน; กรดลอริก; อุตสาหกรรมเภสัชและเครื่องสำอาง

Abstract

Black soldier fly larvae (*Hermetia illucens*) are a valuable source of biomolecules with significant applications in the pharmaceutical and cosmetic industries. This is due to their high protein, mineral, and fat content. This study aimed to investigate the impact of different oil extraction methods on the yield and fatty acid composition of black soldier fly larvae oil. Five different oil extraction methods were employed: Hotplate stirrer 45°C, Hotplate stirrer 65°C, Hotplate stirrer 95°C, Hexane, and Microwave. The results showed that the ultrasonic-assisted Hexane extraction method yielded the highest amount of oil, followed by Hotplate stirrer 95°C, Hotplate stirrer 65°C, Hotplate stirrer 45°C, and Microwave. Fatty acid analysis of the extracted oils revealed that lauric acid was the most abundant fatty acid, followed by palmitic acid, myristic acid, and stearic acid. A comparison of the fatty acid profiles obtained from different extraction methods indicated that the Hotplate stirrer 65°C method was the most suitable for extracting oil from black soldier fly larvae. This is because it yielded oil with a high lauric acid content, which has antioxidant properties and can be further developed into sustainable biomaterials for the pharmaceutical and cosmetic industries.

Keywords: black soldier fly larvae; extraction methods of oil; fatty acid; lauric acid; the pharmaceutical and cosmetic industries

Effect of beta - sitosterol on hippocampal neuronal pathology in mice with ischemia-reperfusion injury

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The present study aimed to evaluate the effect of beta - sitosterol on hippocampal neuronal pathology in mice with ischemia-reperfusion (IR) injury. Forty-male ICR mice were randomly divided into 4 groups of Sham-veh, IR-veh, IR-BSS 50 mg/kg, IR-BSS 100 mg/kg. IR surgery was induced by 30 minute-bilateral common carotid artery occlusion followed by 45 minutes of reperfusion. At the end of the reperfusion period, the histopathological changes in the hippocampus were evaluated using 0.1% cresyl violet staining. The results showed that IR significantly decreased viable cells only in the Dentate gyrus area when comparing IR-veh to Sham-veh ($p < 0.05$). However, BSS treated groups exhibited none of significant difference when compared either with Sham-veh or IR-veh ($p > 0.05$). Our results indicated that IR induction is not severe enough to induce pathological change in CA1 and CA3 but Dentate gyrus neurons. Although pretreatment with BSS tends to preserve the viable neurons in the hippocampus.

Keywords: beta - sitosterol; Antioxidant; hippocampal; ICR mice; ischemia-reperfusion

Effect of beta-sitosterol on brain neuronal pathology in mice with cerebral ischemia reperfusion injury

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Abstract

Cerebral ischemia-reperfusion (IR) injury resulting from blockage of blood vessel to the brain and lead to cerebral ischemic damage and the damage is exacerbated when blood is restored. Beta-sitosterol (BSS), a phytosterol processes variety of health benefits including the inhibition of cholesterol absorption, suppression of cancer cell proliferation, anti-inflammation and anti-oxidation. It is interesting using of BSS for protection against IR induced brain infarction. Therefore, the present study was to explore the neuroprotective efficacy of BSS against cerebral IR injury in mice. Forty-male ICR mice were allocated into four distinct groups: Sham-veh, IR-veh, IR-BSS50, and IR-BSS100. Administration of either beta-sitosterol or a vehicle solution (normal saline) was conducted over a span of seven consecutive days preceding the induction of IR. IR was achieved through 30 minutes of bilateral common carotid artery occlusion followed by 45 minutes of reperfusion. Brain tissues were harvested for the assessment of brain infarction using 2 % TTC staining. Results showed that IR induction tend to increase brain infarction volume but no statistic significant. Consequently, the neuroprotective potential of BSS is not denote due to the fact that the IR induction was not of sufficient severity to precipitate marked pathological manifestations.

Keywords: Ischemia-reperfusion, Beta-sitosterol, Neuropretective

Comparison effect of Beta-sitosterol and Tyrosol on glycemic control in mice

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Prolonged hyperglycemia is pre-clinical sign of metabolic alteration which can lead to diabetes. Therefore, nurturing of glycemic control using nutraceutical is on focus, nowadays. The present study investigated the effect of beta-sitosterol and tyrosol on glycemic control in mice. Fifteen-male ICR mice were randomly divided into 5 experimental groups: Control (received only 10% Tween 80), Try50 (received tyrosol 50 mg/kg), Tyr100 (received tyrosol 100 mg/kg), Bss50 (received beta-sitosterol 50 mg/kg) and Bss100 (received beta-sitosterol 100 mg/kg). Two times oral glucose tolerance test (OGTT) was delivered for glycemic control assessment and defined as OGTT baseline (before treatments) and OGTT treatment (one-week treatment). The results showed no significant difference of glycemic control capacity between Control and treatment groups indicated by OGTT. Treatment with Bss 100 mg/kg tend to reduce blood glucose level indicated by within group comparison. We concluded that one-week treatment with Bss or Tyr exhibit no effect on glycemic control capacity while Bss 100 mg/kg tend to reduce blood glucose level with prolonged administration.

Keywords: Glycemic control; Diabetes; Beta-sitosterol; Tyrosol; ICR mice

Effect of beta-sitosterol on cortical and striatum neurons in mice with ischemia-reperfusion injury

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Beta-sitosterol (BSS) is a phytosterol deliver form legumes and olive oil. BSS has variety of medicinal properties i.e., antioxidant and anti-inflammation. Therefore, using of beta-sitosterol against neuropathology induced by ischemia reperfusion (IR) injury is interesting. The present study aimed to investigate the protective effect of BSS on cortical and striatal neurons in mice with ischemia-reperfusion injury. Forty-male ICR mice were divided into 4 groups: Sham-veh (10% Tween80), IR-veh (10% Tween80), IR-BSS50 (BSS 50 mg/kg) and IR-BSS100 (BSS 100 mg/kg). These oral administrations were continued for 1 weeks before IR induction. IR was inducted by bilateral common carotid artery occlusion for 30 minutes followed by 45 minutes of reperfusion. Brains were collected for histological examination of cortex and striatum by the using of 0.1% cresyl violet staining. The results showed the percentage of degeneration in striatum was significantly increased when compared IR-veh to Sham-veh ($p < 0.05$), while IR-BSS100 group significantly decreased the degeneration compared to IR-veh group ($p < 0.05$) but the percentage of degeneration in cortex was not significantly difference. The present study concluded that the striatal neurons are sensitive to IR than cortex neurons and beta-sitosterol 100 mg/kg can prevent striatal neurons degeneration in mice with cerebral ischemia-reperfusion injury.

Keywords: Beta-sitosterol, ischemia-reperfusion injury, antioxidant, cortex, striatum

Diversity of birds at Kasetsart University, Bang Khen Campus

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Increasing urbanization has affected the landscape composition of cities, directly impacting the composition of bird communities. From the perspective of a biodiversity-friendly city, university campuses can play a key role as important urban green spaces for biodiversity in several cities including Bangkok metropolis. This study aims to examine how landscape characteristics affect bird communities' responses at Kasetsart University, Bang Khen Campus. Four transect surveys covering three types of habitat were conducted monthly from February to September 2023. As a result, a total of 7451 individuals, 71 species belonging to 39 families, and 15 orders have been provided. Shannon-Wiener Index of Diversity (H') of the campus at 3.01. The dominant bird species are more adaptive species composed of the Eurasian Tree Sparrow (*Passer montanus*), Rock Pigeon (*Columba livia*), and Asian Palm Swift (*Cypsiurus balasiensis*) respectively. Omnivores and insectivores birds were more abundant on the campus than all other functional groups. The species composition differed significantly between the different lands used. Abundance, Shannon diversity index, and similarity index among transects were examined. Our result indicated that the university's green spaces can sustain a higher diversity of birds throughout the year and could be a model for future urban area planning and bird community diversity protection.

Keywords: species diversity, birds, campus green space, habitat utilization, urbanization

Proximate Analysis of Reticulated Python (*Malayopython reticulatus*) Meat

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Captive Reticulated Python (*Malayopython reticulatus*) has been used only for its skin in the leather industry but the rest, such as bones, internal organ and meat are discarding and required large expenses for eliminating. Meat is an important source of human essential nutrients. In Thailand, snakes are utilized in various benefits, such as consuming snake meat as food since ancient times. However, there have been no reports on the nutritional values of snake meat. The aim of this study was to analyze the important chemical composition of python meat by using samples from python snake farm in Uttaradit province, including the meats that attached to skin and to bone. The meats were freeze dried and analyzed the chemical composition by proximate test and determined physicochemical properties of the fresh python meat that attached to skin part (pH value and water holding capacity values from drip loss method and centrifuged method). Results showed the data from proximate analysis (ash, moisture, protein, carbohydrate and fat) and demonstrated significant differences among muscles ($p < 0.05$) from each other. Comparing to pork, beef, and chicken meats, the python meat had higher protein content. The pH and water holding capacity (centrifugation method) of snake did not differ significantly ($p > 0.05$), but the drip loss was significantly different ($p < 0.05$). In conclusion, the python meat could be a new alternative source of protein which has higher protein than a meat that we normally consume so it could be developed into food or health products in the future.

Keywords: *Malayopython reticulatus*; Python; Protein; Chemical composition; Physicochemical properties

Effects of carbon (coconut endosperm residue) to nitrogen (soybean curd residue) ratio on growth performance and efficiency of conversion of digested food to biomass in black soldier fly larvae (*Hermetia illucens*)

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The black soldier fly larvae (*Hermetia illucens*) are insects that can help reduce organic waste and convert agricultural by-products into valuable biomass as a source of protein and fat in many economic animal feeds. It also has potential for application in the production of antimicrobial substances, cosmetics, biodiesel, etc. The objective of this research is to study the carbon/nitrogen ratio in mixed diets between coconut endosperm residue (C) and soybean curd residue (N) suitable for the growth performance and efficiency of conversion of digested food to biomass of black soldier fly larvae (BSFL). BSFL aged 7 days were fed with mixed diets of coconut endosperm residue and soybean curd residue in 17 different ratios. Each formula was replicated 3 times, with each replicate receiving larvae of equal weight. The experiment was terminated when observed 1 or more prepupal stage. The results showed that BSFL fed the C35:S65 and C20:S80 diets had same and maximal growth rates of 1.81 grams/day. The highest substrate reduction and waste reduction index were observed in the C20:S80 diet were 70.8% and 4.43 grams/day. The highest efficiency of conversion of digested food was found in the C65:S35 diet was 0.67, which corresponds to the carbon and nitrogen sources affecting the growth performance of BSFL. In conclusion, the study highlights the value and quality of BSFL as a sustainable resource, suitable for utilization in livestock production industries. Additionally, their role in organic waste reduction contributes to environmental sustainability.

Keywords: Black soldier fly larvae; Growth performance; Food Waste; Coconut endosperm residue; Soybean curd residue

The use of black soldier fly larvae (*Hermetia illucens*) to replace tuna in the complementary diet of cats as licking snack

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The most common source of protein in cat food is tuna. However, the continuous increase in its cost and the issue of food contamination due to heightened environmental pollution have prompted efforts to explore new protein sources for cat food production. The black soldier fly larvae (*Hermetia illucens*) are regarded as a sustainable alternative protein source. Substituting tuna with black soldier fly larvae could potentially reduce production costs, resulting in more affordable and quality-controlled products. The objective of this study was to compare the acceptance of wet snacks by cats using black soldier fly larvae as a protein source at three different levels: 0, 50, and 100%, respectively. The food acceptance test was conducted over 9 days on adult cats without clinical symptoms, totaling 20 animals divided into 5 groups of 4 animals each. From the experiment, it was observed that the acceptance of recipes 1 was the highest, followed by recipes 2 and 3, with acceptance rates of 95, 74, and 33%, respectively. Statistical analysis revealed a significant relationship between the recipes and food acceptance ($P < 0.05$). The evaluation of food acceptance depended on the cats' eating behavior, the quantity of food consumed, and their interest in the food. The study concluded that the inclusion of black soldier fly larvae in snack foods resulted in reduced palatability. Therefore, if substituting tuna with black soldier fly larvae, it is advisable to use a recipe containing equal proportions of both ingredients. However, further development of techniques and product improvement is necessary to enhance palatability.

Keywords: black soldier fly larvae, cat, food acceptance, source of protein, tuna

Study of Collagen from Reticulatus Python (*Malayopython reticulatus*) Bone for Commercial Use

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Collagen is a group of proteins that are important to the human body. Currently, collagen from animals is being developed for use. However, there are no reports about collagen from pythons (*Malayopython reticulatus*). Currently, the python skin is only used for fashion products while other parts are discarded and leading to high disposal costs. This study used python bone attached the meat in body part (bone attached meat) samples from a breeding farm in Uttaradit province. The samples were clean, freeze drying and performed to analyze the amounts of protein and collagen. Then, the collagen was extract with acid. The extract was examined for the total protein content, and protein pattern by SDS-PAGE electrolysis. Results showed the collagen and protein quantities were 17,388.83 mg/ 100g and 63.95 g/ 100g, respectively. The yield of collagen protein extraction was 0.15%, Average value of total protein of the extract was 0.51 mg/ ml. The SDS-PAGE of collagen extract protein demonstrated the main protein bands containing β, α1, and α2 chains were found with molecular weights of 245, 135 and 125.49 KDa, respectively, corresponding to the protein bands of collagen type I from calf skin. The results of this research study revealed that the collagen extracted from the python bone attached meat is type 1 collagen. The results of this study are important basic information that will lead to increasing value of the python bones and can be a new alternative source of collagen in the industry.

Keywords: *Malayopython reticulatus*; Snake; Bone; Collagen; Protein

Population genetics study of the paddle crab, *Varuna yui* in Thailand

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Paddle crab belonging to the family Varunidae, inhabits freshwater, brackish, and saltwater environments. In Thailand, there are two species: *Varuna litterata* and *Varuna yui*. They are commonly used in various local dishes, especially the mature stage before laying eggs resulting in a rapid decline in population. Despite their long-standing popularity and economical importance, their genetic diversity has not been studied sufficiently for sustainable utilization, especially *Varuna yui*, which was discovered later. Thus, this study aims to investigate genetic variation in five populations of *Varuna yui* in Thailand, i.e. Prachuap Khiri Khan (PKN), Chanthaburi (CPM), Chachoengsao (CCO), Phetchaburi (PBI), and Samut Sakhon (SKN). The analysis of the control region (D-loop) of mitochondrial DNA demonstrated that the paddle crab populations were divided into two genetic groups: A and B. However, the groupings did not correspond to the geographic origins of the populations, except for SKN (all in group A) and PBI (all in group B). Both haplotypes were found in the same province, likely due to the initial introduction of these crabs with both haplotypes. Despite the genetic distance between A and B groups were high (average = 1.10), the average genetic distance within populations group were low (0.0109, 0.0084). Considering the observation that SKN and PBI populations contain only one haplotype, this could be attributed to the lower frequency of the other haplotype in these provinces, and thus more sampling will be required to clarify on this. Nonetheless, the low genetic diversity within population group, and the sign of decreasing in population size in CPM, raises concerns for sustainable use and conservation. Further population study together with implementing stricter regulations on overfishing, is crucial to maintain genetic diversity of *Varuna yui*.

Keywords: genetic diversity, population structure, mitochondrial DNA, control region

Evaluation of microsatellite marker polymorphism in red palm weevil by using targeted next generation sequencing

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Rhynchophorus ferrugineus so called red palm weevil, Asian palm weevil, or sago palm weevil are currently in high demand because their larvae are food with nutritional value. Despite the obvious phenotypic diversity of the red palm weevil, rearing it in farms without sustainable management may lead to a reduction in genetic diversity due to inbreeding. Microsatellite markers have been reported to be one of the best markers for studying genetic diversity in populations, and they were developed in this species. However, the conventional method requires fluorescent tagging of primers and fragment analysis, which is rather costly and time-consuming, especially for ineffective loci. Thus, it is important to screen polymorphic loci before applying them to the study of populations. Here, we used next-generation sequencing (NGS) to screen microsatellite markers in eight populations (384 individuals) of the red palm weevil in Thailand.First, screen 28 pairs, then select 16 pairs, and finally analyze the results of 8 pairs. Seven primer pairs obtained from research papers, and one primer pair was newly designed. All eight primer pairs were tested and verified by PCR first. PCR products were then pooled and sequenced by next-generation sequencing (NGS). However, we obtained results from only seven loci. One locus that was missing may be due to concentration. Of these seven loci, the number of alleles ranged from five to 20, and PIC ranged from 0.184 to 0.989. Thus, targeted microsatellite sequencing can be applied for the selection of microsatellite markers.

Keywords: population, genetic diversity, *Rhynchophorus ferrugineus*

Detection of *Bombyx mori* nucleopolyhedrovirus (BmNPV) in silkworms by molecular method

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Grassery disease in *Bombyx mori* silkworms is caused by *Bombyx mori* nucleopolyhedrovirus (BmNPV). The silkworms eat mulberry leaves that are contaminated with the BmNPV. When the BmNPV virus enters the silkworm, it can spread quickly and eventually lead to the death of silkworms. The objective of this study was to examine the BmNPV infection in silkworms using polymerase chain reaction (PCR) technique. Three BmNPV genes were used in this study: *ie-1*, *gp64* and *dna pol*. Fifty-five silkworms from the Queen Sirikit Department of Sericulture were used as the samples for BmNPV detection. Twenty-two were labeled as the non-BmNPV infected group and thirty-three were the BmNPV-infected group. The result showed that in the non-BmNPV infected silkworms, we found fifteen silkworms were infected. For the BmNPV-infected group, ten silkworms were infected. Our results suggested that the detection of BmNPV by PCR method could be used to examine the virus infection which was more sensitive than the conventional methods.

Keywords: *Bombyx mori* nucleopolyhedrovirus (BmNPV), PCR, silkworm

Gene expression of odorant receptors in *Bombyx mori* moth upon the mulberry odor preferences for spawning

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Bombyx mori silk moths have olfactory antennae on the their heads that they use to find their favorite scents. The silk moths have odorant receptors (Ors) which are the chemoreceptors that play an important role in the recognizing of odorant molecules in the olfactory system. The information from the Queen Sirikit Department of Sericulture showed the reduction of egg spawning of *Bombyx mori* silk moths over the years. The objective of this research was to examine the expression levels of twenty *Bombyx mori odorant receptors* (*BmOrs*) upon the various conditions for egg spawning. After fertilization, spawning eggs were counted and the antennae of female silk moths were collected for detection of *BmOrs* expression levels. The results showed that the % spawning rate from lowest to highest ones were wet glue (control), wet glue with mulberry powder 1%, mulberry leaves, and mulberry powder 1%, respectively. The expression level of *BmOr63* gave the highest level in wet glue with mulberry powder 1% while *BmOr47* showed the lowest expression in mulberry leaves condition.

Keywords: Gene expression, *Bombyx mori*, odorant receptors, qRT-PCR

การเก็บรักษาเชื้อพันธุกรรมของ *Lemna aequinoctialis*
Cryopreservation of *Lemna aequinoctialis*

ข้อมูลนิสิตผู้ทำโครงงาน

ชื่อ-สกุล : พิชญาภัคร์ ตันติยาภินันท์

บทคัดย่อ

Cryopreservation คือ การเก็บรักษาเนื้อเยื่อที่อุณหภูมิติดลบ วิธีที่นิยมที่สุดคือ การเก็บใน
ไนโตรเจนเหลว ซึ่งจะสามารถทำให้เก็บเนื้อเยื่อไว้ได้เป็นเวลานาน ในปัจจุบัน cryopreservation เป็นวิธีที่มี
ประสิทธิภาพมากที่สุดในการเก็บรักษาพืช โดยไม่ทำให้เกิดการเปลี่ยนแปลงของกระบวนการเมตาบอลิซึม
จุดมุ่งหมายของงานนี้คือ ตรวจสอบอัตราการเจริญเติบโต ตรวจสอบประสิทธิภาพในการสังเคราะห์แสงและ
ตรวจสอบการแสดงออกของ *rbcL* ของแหนเป็ดหลังจากถูกเก็บรักษาโดยวิธี cryopreservation จึงนำ *Lemna
aequinoctialis* มาทำ cryopreservation 2 แบบ คือ 1. V-cryo plate นำ daughter frond ลงบน cryo
plate หยด Na-alginate ลงบน plate และนำไปแช่ $CaCl_2$ ทิ้งไว้ 15 นาที และ 2. drop นำ *Lemna
aequinoctialis* ลงใน Na-alginate และหยดลงใน $CaCl_2$ ทิ้งไว้ 15 นาที หลังจากนั้นนำไปแช่ใน LS solution
50 นาที PVS2 30 นาที และนำไปเก็บรักษาในไนโตรเจนเหลว, -20℃, 4℃, อุณหภูมิห้อง และนำไป regrowth
ตรวจสอบอัตราการเจริญเติบโต และตรวจสอบประสิทธิภาพในการสังเคราะห์แสง พบว่าการเก็บรักษาแบบ
drop มีประสิทธิภาพในการเจริญเติบโตหลังจากถูกเก็บรักษาได้ดีกว่าการเก็บรักษาด้วยเทคนิค cryo plate
และมีประสิทธิภาพในการสังเคราะห์แสงใกล้เคียงกับ *Lemna aequinoctialis* ที่เลี้ยงในอาหาร NF โดยที่ไม่มี
การทำ cryopreservation การแสดงออกของ *rbcL* แหนที่ได้รับ pretreatment ABA อย่างน้อย 48 ชั่วโมง
ลดลงเมื่อเปรียบเทียบกับแหนที่ไม่ pretreatment ซึ่งอาจเกี่ยวข้องกับการลดกิจกรรมและเข้าสู่ภาวะ
dormancy ซึ่งจะช่วยให้สามารถงอกได้ใหม่หลังจากทำ cryopreservation

ผศ.ดร.พีรภัฏ รุ่งสัทธรรม

Expression of recombinant *Anopheles* yellow G and saglin proteins in *E.coli*

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Two proteins of *Anopheles* mosquito, saglin and yellow G, were found their importance for *Plasmodium* infection. Saglin acts as a receptor on the surface of the *Anopheles* salivary glands. It facilitates the binding and recognition of specific molecules on the surface of the *Plasmodium* parasite. In previous study, the disruption of the *An. dirus yellow g* gene expression by RNA interference resulted in lower number of *Plasmodium* oocysts in the mosquito gut. This result suggests that *An. dirus* yellow G protein may be important for *Plasmodium* development in mosquitoes. The objective of this research is optimize the expression of the recombinant saglin and yellow G proteins in *E. coli* under IPTG induction. Different final concentrations of IPTG, 0.2, 0.4, 0.6, 0.8 and 1.0 mM, were conducted. The recombinant protein expression patterns were examined by SDS-PAGE. The results showed that the expression of both recombinant proteins was found at 0.6 mM IPTG induction for 4 hours at 37°C. However, these results will be further confirmed by Western blot. In addition, other factors, such as temperature, the duration of IPTG induction, could also be optimized to obtain a higher level of recombinant protein production.

Keywords: Recombinant protein expression, Yellow G, Saglin*, Anopheles*, Malaria

การพัฒนาไพรเมอร์ที่จำเพาะกับชนิดของเห็ดทรัฟเฟิลและไพรเมอร์สำหรับตรวจสอบเห็ดทรัฟเฟิลทั่วไป

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บทคัดย่อ

เห็ดทรัฟเฟิล (*Tuber spp.*) เป็นเห็ดที่มีราคาสูงที่สุดในโลก เป็นเชื้อราไมคอร์ไรซาชนิดหนึ่งที่อาศัยอยู่แบบพึ่งพากับพืชวงศ์กำลังเสือโคร่ง (*Betulaceae*) และพืชในวงศ์ก่อ (*Fagaceae*) ในประเทศไทยมีสามชนิด ได้แก่ *Tuber thailandicum, T. lannaense* และ *T. magnatum* ซึ่งพบที่ดอยสุเทพ-ปุย เชียงใหม่ เนื่องจากการสำรวจเห็ดทรัฟเฟิลเป็นไปได้ยาก ในการวิจัยนี้จึงออกแบบไพรเมอร์เพื่อใช้ในการเพิ่มปริมาณดีเอ็นเอที่จำเพาะกับเห็ดทรัฟเฟิลทั้ง 3 ชนิด และไพรเมอร์ที่จำเพาะกับเห็ดทรัฟเฟิลทั่วไป และใช้เทคนิค NGS-based amplicon sequencing เพื่อตรวจสอบอีกทางโดยใช้ตัวอย่างดินที่เก็บจากพืชอาศัยของทรัฟเฟิลในภาคเหนือทั้งหมด 27 ตัวอย่าง ผลการทดลองพบว่าไพรเมอร์ของ *T. thailandicum* สามารถเพิ่มปริมาณดีเอ็นเอของ *T. thailandicum* ได้ทั้งหมด 10 ตัวอย่าง ในขณะที่ไพรเมอร์ที่จำเพาะกับ *T. lannaense* และ *T. magnatum* และไพรเมอร์ที่ออกแบบมาเพื่อเพิ่มปริมาณเห็ดทรัฟเฟิลได้ทุกชนิดกลับไม่สามารถเพิ่มปริมาณดีเอ็นเอของเห็ดทรัฟเฟิลในตัวอย่างได้เลย ผลการตรวจสอบชนิดของเห็ดทรัฟเฟิลจากเทคนิค NGS พบว่ามี 3 ตัวอย่าง ที่มี *T. thailandicum* โดย 3 ตัวอย่างที่พบนี้สอดคล้องกับผลการตรวจสอบด้วยไพรเมอร์ *T. thailandicum* ด้วย ผลการทดลองแสดงให้เห็นว่าไพรเมอร์ที่จำเพาะมีความไวสูงกว่า NGS ได้ ในขณะที่การไม่พบเห็ดทรัฟเฟิลชนิดอื่นๆ โดยการตรวจสอบทั้งสองวิธีอาจคาดได้ว่าในตัวอย่างที่ศึกษาไม่มีเห็ดทรัฟเฟิลชนิดอื่นอยู่เลยและทำให้ไม่สามารถยืนยันประสิทธิภาพของไพรเมอร์ที่ออกแบบได้

คำสำคัญ: *Tuber thailandicum, T. lannaense, T. magnatum,* NGS-based amplicon sequencing

Genetic variation of avirulence genes in rice blast isolates from Vietnam

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Magnaporthe oryzae is an ascomycete fungus and the causal agent of rice blast disease. The fungus targets grains, leaves, and the stem at the base of the panicle. On the leaves, there are little brown dots that gradually develop into longer, rhombic-shaped patterns. Rice blast disease is a devastating rice disease causing yield losses and threatening rice production. A total of thirty-four *Magnaporthe oryzae* isolates were collected from infected rice showing typical rice blast symptoms from different rice-growing areas of Vietnam. In the analysis, Gene-specific primers were used for this study. This study to determine the mating types of rice blast fungus and identify the *AVR Pi9* and *AVR Pik* genes of the rice blast fungus from Vietnam. This study revealed genetic variation of avirulence genes in Vietnam rice blast. The results showed all of rice blast isolates in this study have mating-type *MAT1-2*. *AVR-Pik* and *AVR-Pi9* genes were found in thirty-four rice blast isolates from Vietnam. Rice that contains *Pik* and *Pi9* genes can be resistant fungus infection because *AVR-Pik* and *AVR-Pi9* genes exist in rice blast fungus from Vietnam. The study could provide helpful data to predict the possible future adaptation of Thailand's rice blast fungus, thus, enabling the future development of breed strategies for rice blast-resistant varieties in Thailand.

Keywords: *Magnaporthe oryzae*, Rice blast fungus, Rice blast disease, Avirulence gene

การศึกษาผลกระทบของปรอทต่อแหนเป็ด
Study the effects of mercury on duckweed

ข้อมูลนิสิตผู้ทำโครงการวิจัย
ชื่อ-สกุล ธนัชพร เที่ยงสัตย์

แหนหรือ duckweed เป็นชื่อสามัญของ Lemnaceae ห้าสกุลหลัก: *Lemna, Spirodela, Landoltia, Wolffia และ Wolffiella* เป็นพืชน้ำที่เล็กและเติบโตเร็วที่สุดในโลก รวมถึงมีความอุดมสมบูรณ์ของสารอาหาร จึงเป็นแหล่งอาหารของสัตว์ เนื่องจากมีอัตราการสะสมชีวมวลและสารอาหารสูง ความไวต่อสารพิษบางชนิด และมีประโยชน์ในการตรวจติดตามทางชีวภาพและการบำบัดทางชีวภาพในน้ำที่ปนเปื้อนนอกจากนี้มีการศึกษา ประสิทธิภาพของในการดูดซับโลหะหนักจำพวกตะกั่วและแคดเมียม แหนมักใช้เพื่อดูดซับโลหะที่เป็นพิษจากน้ำ เสียจากโรงงานที่มีการถ่ายน้ำเสียลงในแหล่งน้ำ ในการทดลองนี้ใช้แหนเป็ดทั้งหมดสองชนิดคือ *Spirodela polyrhiza* และ *Lemna aequinoctialis* ใช้สารปรอท หรือ mercury ซึ่งมีอิทธิพลกับสิ่งมีชีวิตสูงกว่าสารเคมี ปนเปื้อนในแหล่งน้ำชนิดอื่น อีกทั้งสามารถยับยั้งกระบวนการต่าง ๆในพืช เช่น การสังเคราะห์ด้วยแสง การ หายใจหรือ respiration การงอกของเมล็ดและการงอกของละอองเกสรดอกไม้ ซึ่งการแสดงออกของยีนสามารถ นำมาตรวจสอบการปนเปื้อนสารพิษในแหล่งน้ำได้จากการดูดซึมเข้าในร่างกายของพืชหรือสัตว์และในสิ่งมีชีวิต พบว่ามียีน Ribulose-bisphosphate carboxylase หรือ *rbcL* อยู่บนคลอโรพลาสต์จีโนม ซึ่งเป็นยีนที่ กำหนดการสร้างหน่วยย่อยขนาดใหญ่ของเอนไซม์ Ribulose 1, 5 bisphosphate carboxylase/ oxygenase หรือ RUBISCO เป็นเอนไซม์ที่ช่วยจับคาร์บอนไดออกไซด์ในการสังเคราะห์ด้วยแสงของพืช ซึ่งการเปลี่ยนแปลง ของ *rbcL* สามารถประเมินความเสียหายของระบบการทำงานสำหรับการสังเคราะห์ด้วยแสงได้จึงนำมาสู่ การศึกษาเพื่อตรวจสอบการศึกษาผลกระทบของปรอทต่อแหนเป็ดรวมไปถึงการแสดงออกของยีน Ribulose-bisphosphate carboxylase ต่อความเครียดในแหนเป็ดหลังมีการเลี้ยงร่วมกับอาหารที่มีส่วนผสมของปรอท ในความเข้มข้นต่าง ๆ โดยการสกัด RNA เพื่อดูการแสดงออกของยีนของแหนเป็ดที่ได้รับผลกระทบจากปรอท พบว่าปรอทมีผลกระทบต่อแหนเป็ดอย่างชัดเจนทั้งประสิทธิภาพการสังเคราะห์แสงและพื้นที่สีเขียวแปรผกผัน กับความเข้มข้นของปรอทที่ใช้ทำการทดลอง แหนเป็ดมีประสิทธิภาพในการสังเคราะห์แสงลดลงจากการวัดของ ปริมาณคลอโรฟิลล์เอ, บี, คลอโรฟิลล์รวม และกราฟพื้นที่สีเขียว

ผศ.ดร.พีรภัฏ รุ่งสัทธรรม

Lettuce Disease Detection using Deep Learning Techniques.

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This study presents a salad disease detection system utilizing deep learning techniques. The system employs an AI model to identify potential abnormalities in salad vegetables, offering preliminary solutions and recommendations. Users can access the system by adding a custom Line Chatbot as a friend and uploading images through the chat interface. Upon image upload, the Line API interacts with a server hosting the deep learning model via a webhook. The model analyzes the image and responds with the predicted disease class or problem (e.g., leaf burn, leaf spot, worm infestation) along with basic troubleshooting instructions. We evaluated five models: Convolutional Neural Network (CNN), VGG16, ResNet152V2, Support Vector Classification (SVC), and Random Forest. These models were trained to classify salad images into five categories: leaf burn, leaf spot, worm infestation, unspecified problem, and healthy. The experimental results indicate that the ResNet152V2 model achieved the highest accuracy, with a Precision of 0.94, Recall of 0.94, F1-Score of 0.94, and Accuracy of 0.9417.

A Classification of Venom Snake from Images using Deep Learning Techniques

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This study aims to develop a tool to help people identify whether encountered snakes are venomous. The method involves users uploading an image of the snake to a custom Line Chatbot. The Line API communicates with a server hosting a deep learning model through a webhook. This model processes the image, predicts the snake species and its venom status, and sends the information back to the user. We evaluated five deep learning models: Convolutional Neural Network (CNN), EfficientNet, ResNet50, Inception-ResNet, and VGG16. Each model was trained on three datasets: 1) one containing 35 snake species, 2) one for venomous or non-venomous classification, and 3) one focusing on 10 snake species found in Thailand. The evaluation results showed that the EfficientNet model, trained on the dataset of 10 species, achieved the most efficient performance, with an F1-Score of 0.902, Recall of 0.901, Precision of 0.903, and Accuracy of 0.901.

Sentiment Analysis using Product Review Data

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This study analysed customer sentiment from Shopee product review texts, classified as positive or negative, to help sellers understand their customers and improve problem-solving responsiveness to customer needs. The process involved developing sentiment analysis models using natural language processing techniques and deep learning. Reviews were preprocessed with word segmentation, stop word and emoji removal, and word embedding. Then, the text is sentiment classified by using deep learning models including Fully Connected Neural Networks, LSTMs, BiLSTMs, and BERT. The Fully Connected model achieved the best classification results with an accuracy of 83%. The developed system retrieves product review data from Shopee stores, classifies sentiment, and displays results in a user-friendly graphical format using Looker Studio. Python was used to interact with APIs, store data in Google BigQuery, and store classified reviews in Google Data Warehouse. Users can view results by sentiment category for further product and service improvements.

Efficient University Official Document Storage and Retrieval using *YOLOv8* and *Tesseract OCR*

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This project aims to develop a university document management and search system that streamlines the process of locating university announcements and memorandums. The system employs the YOLOv8 deep learning model to identify and extract eight key components from documents: Logo, Emblem, Title, Subtitle, Content, QR code, Signature, and Table. To optimize data storage and search efficiency, the system focuses on the Title and Content components. Images of these components are pre-processed to enhance the accuracy of the Optical Character Recognition (OCR) process, which is performed using the open-source Tesseract OCR tool. The extracted text is then used to generate keywords, which are stored in a database. This approach enables users to search for relevant university documents quickly and efficiently, saving time and resources. By leveraging YOLOv8 and Tesseract technologies, this system revolutionizes the way users access and retrieve critical information from university official documents.

The properties of local generalized rough set

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In rough set theory, an approximation space (U,R) is a pair of finite set U and the equivalence relation R on U. A subset X of U is said to be exact or definable if $\underline{R}(X) = \overline{R}(X)$.

In our project, we established the conditions on the parameters α and β implies that $\underline{R}_\alpha(X) = X$ if and only if $\overline{R}_\beta(X) = X$.

Keywords: Rough set theory, Local rough set, Exact set.

Study the performance of Thailand mutual funds compared to the market

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In each investment, it is normal for investors to want returns that are in line with their hopes. But some people are not comfortable investing on their own. So decided to invest the money in mutual funds. Usually, investing in mutual funds should have satisfactory returns and low risk. Investors must choose to invest in mutual funds that can provide the expected returns. The creator has therefore studied the performance of mutual funds compared to the market. In what direction is the trend likely? We have selected 20 Thai mutual funds by looking at the historical prices of each fund and the stock exchange. (Data collected from 1 January 2021 to 30 June 2023) which the market to be considered is SET50. After that, Regression was performed to bring the results to summarize the above problems using the Capital asset pricing model (CAPM) method and Hypothesis testing under the t distribution
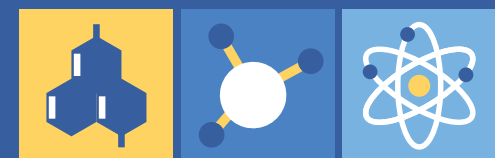
From the hypothesis testing, investors should choose to invest in B-TNTV, KFCASHRMF, K-SET50, KTPLUS, KTSS and T-CASH. Because these 6 funds have α significantly different from 0 at the confidence level of 95% , can be used in both one-way and two-way hypothesis testing. That is, there will be a lower risk than the market. and vice versa If investors want to invest in mutual funds that have the highest returns. The predictions are made using the Capital Asset Pricing Model (CAPM) method. In descending order there are mutual funds K-SET50, KGLTF, SCBDV, CG-LTF, KFLRMF and VALUE-DLTF, respectively.

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