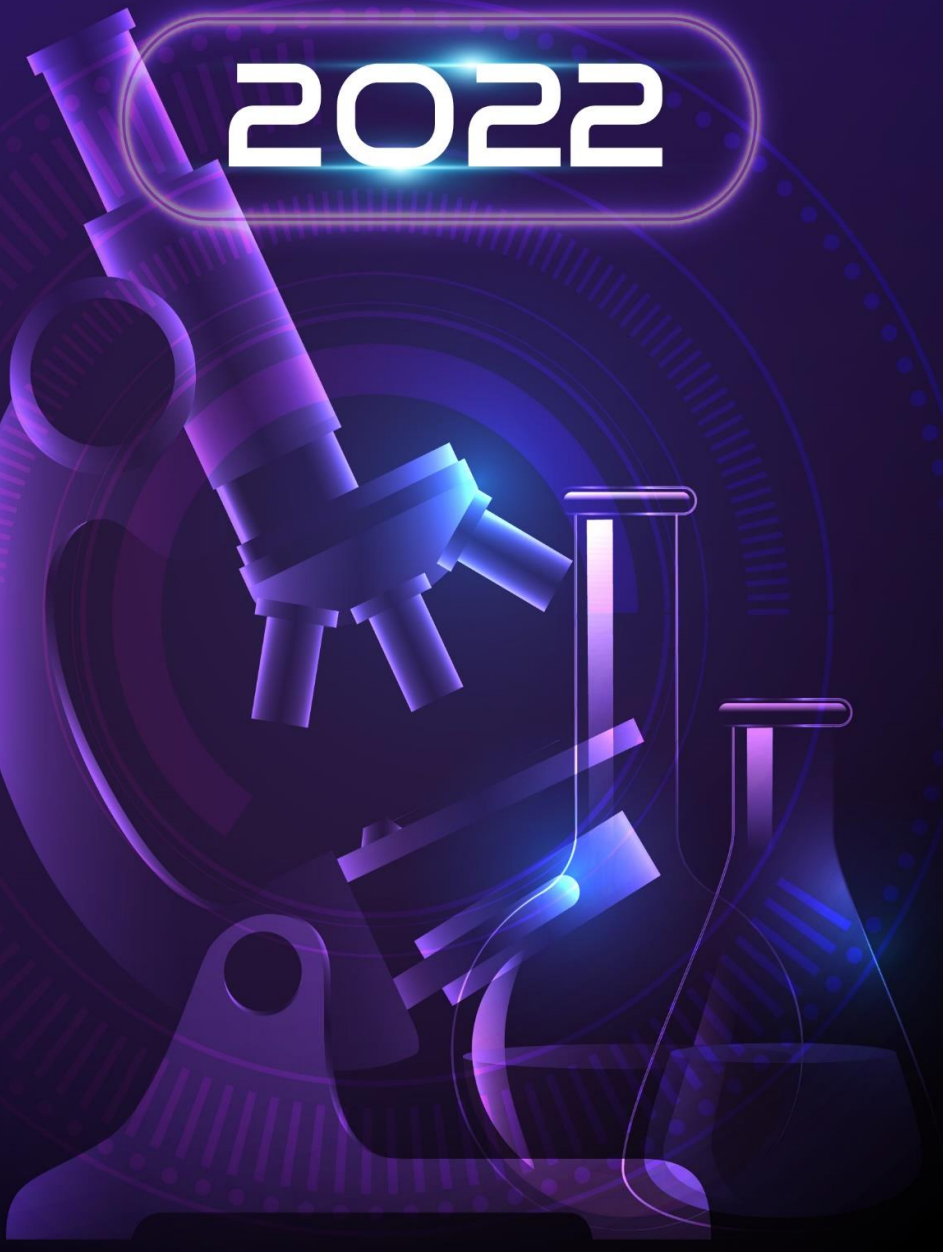
KU FACULTY OF SCIENCE
KASETSART UNIVERSITY คณะวิทยาศาสตร์

80

KUSTARS

KASETSART UNIVERSITY SCIENCE TECHNOLOGY ANNUAL RESEARCH (KUSTARS)

2022



รวบรวมผลงานวิจัย ระดับปริญญาตรี

คณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์

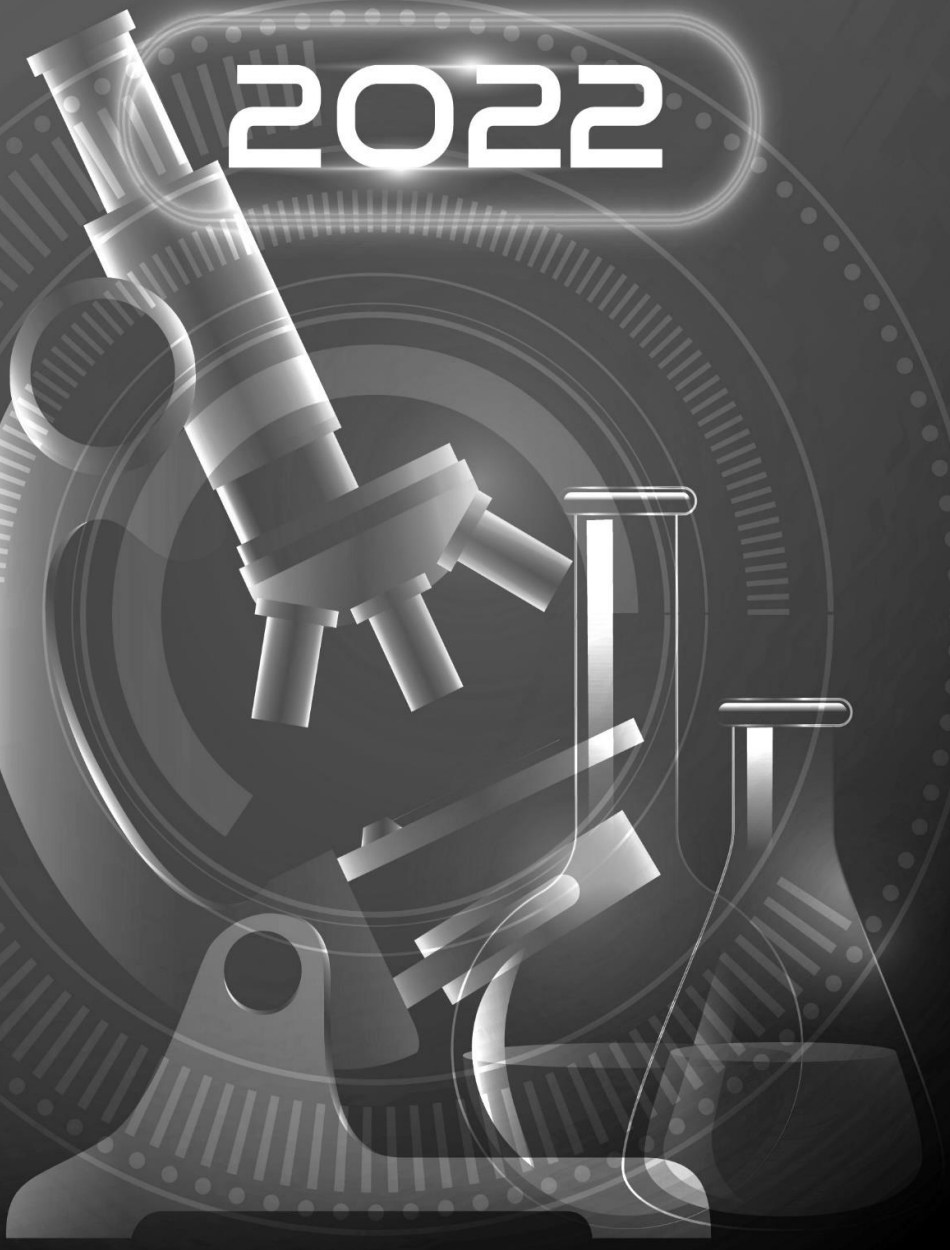
KU FACULTY OF SCIENCE
KASETSART UNIVERSITY คณะวิทยาศาสตร์

80

KUSTARS

KASETSART UNIVERSITY SCIENCE TECHNOLOGY ANNUAL RESEARCH (KUSTARS)

2022



รวบรวมผลงานวิจัย ระดับปริญญาตรี

คณะวิทยาศาสตร์ มหาวิทยาลัยเกษตรศาสตร์

Title Kasetsart University Science Technology
Annual Research (KUSTARS 2022)
Publisher and organized by
Faculty of Science, Kasetsart University, Bangkok, Thailand
Tel 02-5625444 ext 646141-646144
Edition 1/2023
Year 2023
Website https://www.sci.ku.ac.th/kustars/228-2/

National Library of Thailand Cataloging in Publication Data

ISBN (e-book) 978-616-278-788-1

TABLE OF CONTENT

Physical Science

Chemistry

Physics

Earth Science

Statistics

Biological Science

Microbiology

Biochemistry

Botany

Genetics

Applied Radiation and Isotopes

Zoology

Bioscience and Technology

Synthetic 3DOM perovskite@graphene for battery

Tasanan Tirapanich*
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand.
tasanan.t@ku.th
Sutasinee Kityakarn
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand.
sutasinee.k@ku.th

Currently, the fossil energy crisis is continuously increasing due to increasing energy consumption. Consequently, alternative energy sources and energy storage in the form of batteries are interested in reducing the energy crisis. Zinc-air batteries are a new alternative energy source in the metal-air battery category that are less toxic and lower in cost. Due to the limited power output, to increase the performance and quality of the battery, a higher surface material is required. The three-dimensionally ordered microporous perovskite (3DOM-perovskite) structure is therefore suitable and interesting to develop. In this work, we deliver the design materials as three-dimensionally ordered macroporous (3DOM) -$LaCoO_3$ -based perovskite, including $LaCoO_3$, $LaNiO_3$, $LaCo_{0.67}Ni_{0.33}O_3$,$La_{0.90}Ce_{0.10}Co_{0.67}Ni_{0.33}O_3$, were used the polymethyl methacrylate (PMMA) as a template. The physical and electrochemical characterizations were investigated. The thermogravimetric analysis (TGA) showed the weight loss of the decomposition of water moisture on the surface, organic solvents, and the remaining PMMA templates. Later, the crystallinity and morphology of 3DOM perovskite by x-ray diffraction spectroscopy (XRD) and scanning electron microscopy (SEM) techniques showed that the synthesized 3DOM perovskite has a porous rhombohedral crystal structure and shrinks the pore size of 375.08 nm, down to about 170 nm from the PMMA template region which causes the perovskite formation and PMMA decomposition. The electrochemical properties of 3DOM perovskite using the linear sweep voltammogram (LSV) technique, and measuring the electrode discharge potential, LNO-CB showed the highest current density compared to the others. The cyclic voltammetry (CV) technique showed the highest current density of the LCNO-CB and the effect of adding Ni in $LaCoO_3$ -based perovskite to improve the accelerator area to increase battery capacity and efficiency.

Keywords: Zinc-air battery, perovskite, 3DOM structure, $LaCoO_3$ based, Ni-doped

Trimethylamine Adsorption by Amino–Functionalized UiO-66 Metal Organic Framework

Ketsiree Sooncharoen*
Kasetsart University, Bangkok, Thailand ketsiree.so@ku.th

Ramida Rattanakam Kasetsart University fscirdr@ku.ac.th

Seafood is a popular food around the globe due to its nutritional value and appetizing taste. It is recognized for its potential to reduce the risk of developing various diseases when consumed in moderation and is therefore an essential component of human nutrition. On an average, fish and shrimp contain about 80% water with a pH range of 6–7, making them susceptible to spoilage. Spoilage processes alter the quality of seafood, leading to changes in smell, appearance, and taste as a result of various chemicals released during the food degradation. In the current study, Solid Phase Micro Extraction Gas Chromatography Mass Spectrometry (SPME-GC-MS) was used to determine the compounds responsible for the putrid odor of Saba and Pacific prawns. Analysis of the results isobutyl isovalerate, indole, alcohols, amines and sulfides as the highest-ranking compounds.

Since earlier studies have demonstrated the relationship between the release of trimethylamine (TMA) and the freshness of seafood. In this study, we also investigated the adsorption of TMA onto metal organic framework UiO-66-NH_2. Our results indicate that TMA was adsorbed within the UiO-66-NH_2 structure, as confirmed by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and thermogravimetric analysis (TGA).

Keywords: seafood, fish and shrimp, spoilage, trimethylamine, adsorption, metal-organic framework

Synthesis of single-site aluminum catalysts and their application in the ring-opening polymerization of *rac*-lactide

Kunanon Jampakaew*
Kasetsart University, Bangkok, Thailand, kunanon.jam@ku.th

Pimpa Hormnirun, Kasetsart University, fscipph@ku.ac.th

Aluminum complexes supported by ONN-(phenolate) ligands (**1**-**12**) were synthesized and characterized using ^{1}H NMR spectroscopy. These aluminum complexes were evaluated as initiators for the ring-opening polymerization (ROP) of *rac*-lactide in the presence of benzyl alcohol at 70 °C. Good catalytic activity was observed for the aluminum complexes in the polymerization of *rac*-lactide, and these complexes effectively controlled the molar mass and dispersity ($Đ$ = 1.13-1.47). The polymer microstructure was investigated using homonuclear decoupled ^{1}H NMR spectroscopy. All aluminum complexes produced isotactic-biased PLAs with a P_m value in the range of 0.56-0.72. Kinetic studies demonstrated that all complexes mediated the polymerizations with a first-order dependence on the monomer concentrations. Aluminum complexes possessing sterically unhindered ligands displayed higher polymerization rates. In addition, increasing the flexibility of the ligand structure was found to enhance the polymerization rate.

Keywords: Aluminum complex, single-site catalyst, polylactide, ring-opening polymerization

Preparation of cellulose-based nanocomposite and application in selective adsorption of some organic dyes in wastewater

Chalita Saipho*
Kasetsart University, Bangkok, Thailand chalita.sai@ku.th

Peerada Yingyuad Kasetsart University fscipdy@ku.ac.th

The purpose of this research was to prepare cellulose-based nanocomposites and assess their performances in selective adsorption of some organic dyes in wastewater. Cellulose nanofiber (CNF) can be prepared from TEMPO-mediated oxidation of microcellulose (MCC), followed by defibrillation process. The obtained CNF, together with carboxymethyl cellulose (CMC) were crosslinked using appropriate ratio of citric acid to fabricate hydrogel composites. The strength of the hydrogel composite could be increased by adding suitable amount of inorganic additives such as montmorillonite (MMT). Moreover, the addition of polyvinyl alcohol (PVA) facilitated the formation of free-standing hydrogel composites. The morphology and functional groups of the prepared hydrogels were examined using Scanning Electron Microscopy (SEM) and Fourier Transform Infrared Spectroscopy (FTIR). Adsorption studies were carried out using methylene blue (MB) solution and the absorbance of residual dye was measured by UV-Vis Spectrophotometer. It was found that the prepared hydrogel composite at the appropriate ratio could adsorb MB and the adsorption capacity was higher in basic pH. As the initial concentration of the dye increased, the adsorption capacity of the hydrogel increased as well. In addition, the hydrogel composite exhibited high adsorption selectivity to cationic MB compared to anionic MO. The hydrogel composite also showed good reusability with markedly decreased in adsorption capacity after 3 cycles.

Keywords : cellulose, hydrogel composite, physical crosslink, adsorption, methylene blue

Virtual screening of Thai herbal medicine for COVID-19

Yatawee Kamtaedthong*
Kasetsart University, Bangkok, Thailand yatawee.ka@ku.th

Supa Hannongbua Kasetsart University fscisph@ku.ac.th

Patchreenart Saparpakorn Kasetsart University fscipnsk@ku.ac.th

The severe acute respiratory syndrome 2 coronavirus, also known as SARS-CoV-2, which is the cause of COVID-19, is transforming people's lives all around the world. Hence, there are many research studies tried to combat SARS-CoV-2 infection. One of the SARS-CoV-2 target used for the treatment is the 3CL protease (3CLpro). Virtual screening is a quick and effective technique to search for the new inhibitors. In this study, the active components in the herbal compositions of Ha-Rak and Pra-Sa-Pro-Yai remedies were investigated in order to search the compounds for inhibiting SAR-CoV-2 3CLpro using virtual screening. Firstly, active components of Ha-Rak and Pra-So-Pro-Yai about 865 molecules from the literatures were constructed and performed energy minimization. Then, all optimized compounds were investigated the binding into the structure of SAR-CoV-2 3CLpro using molecular docking. Cis-Miyabenol C was found to be an interesting compound with the goldscore of 82.19 which is better than an inhibitor of SARS-CoV-2 3CLpro, a peptidomimetic nitrile warheads. Molecular Dynamics simulations were performed to the complex of SARS-CoV-2 3CLpro with cis-Miyabenol C. The root-mean-square deviation (RMSD), root-mean-square fluctuation (RMSF), and radius of rotation (RG) revealed the stability of cis-Miyabenol C in the binding pocket of protease. Analysis of number of Hydrogen bond indicated the ability of cis-Miyabenol C during the binding. From the results, cis-Miyabenol C can be an interesting compound for the development of SARS-CoV-2 3CLpro inhibitor in the future.

Keywords: virtual screening**,** Molecular dynamics simulation, biomolecular modeling and simulation

Effect of Ag NPs on enhanced photocatalysis of Fe_3O_4@TiO_2 nanoparticles

Nutjita Aryuyong
Department of Chemistry, Faculty of Science, Kasetsart University
Bangkok Thailand nutjita.a@ku.th

Pannaree Srinoi
Department of Chemistry, Faculty of Science, Kasetsart University
Bangkok Thailand pannaree@ku.ac.th

This study focuses on the effect of silver nanoparticles on the enhancement of photocatalytic performance of iron oxide coated with titanium dioxide nanoparticles (Fe_3O_4@TiO_2). Iron oxide nanoparticles (Fe_3O_4 NPs) were synthesized using hydrothermal method. The as-prepared Fe_3O_4 NPs were coated with anatase TiO_2 shell using sol-gel method followed by the calcination at 500 °C. Furthermore, the synthesized photocatalysts were coated with different amount of silver nanoparticles (NPs) on the surface. The varied Ag-coated photocatalysts were synthesized with 0.0066 g (1Ag), 0.0132 g (2Ag), and 0.0264 g (4Ag) of $AgNO_3$ as a silver source, respectively. The SEM images of Fe_3O_4@TiO_2-Ag indicated that the size of the photocatalysts increased with increasing the amount of Ag NPs on the surface. Specifically, the size of Fe_3O_4@TiO_2-1, -2, -4Ag photocatalysts were 306, 323, 356 nm, respectively. The formation of Fe_3O_4@anatase-TiO_2 NPs was confirmed by XRD. Additionally, the XRD also results showed the Ag 111, 200 and 311 plane at 37°, which confirmed the presence of Ag NPs on the surface of the photocatalysts. The zeta potential results of the as-prepared photocatalysts demonstrated that the surface charge was negative after coating Fe_3O_4@TiO_2 with Ag NPs. Additionally, the negativity of surface charge increased with increasing the amount of Ag NPs on the surface of Fe_3O_4@TiO_2 photocatalysts.

Keyword: Silver nanoparticles, Magnetic metal oxide, Iron oxide titanium dioxide, Scanning electron microscope, Dynamic light scattering, Zeta potential, X-ray Diffraction

Virtual screening of cyclooxygenase-2 inhibitor from Tamlai Prasumeru recipe

Nusara Glinjun*
Kasetsart University, Bangkok, Thailand nusara.g@ku.th

Supa Hannongbua Kasetsart University, Bangkok, Thailand fscisph@ku.ac.th

Human Cyclooxygenase type 2 (COX-2) is a target enzyme responsible for the body's homeostasis. At present, it is found that most people tend to experience asthma, body aches, limbs weakness, stiff muscles from epilepsy, paralysis, which these symptoms can be found in all ages. It was found that there are many Thai herbs that can be used to helpful treat and alleviate symptoms such as cannabis, long pepper, cloves, cardamom, etc. The purpose of this work is to investigate in details about Thai herbs in the drug formula to Tamlai Prasumeru. To determine which active ingredient inhibits the human cyclooxygenase type 2 enzyme, the study was performed using computational chemistry methods. To investigate the binding between ligands and COX-2, molecular docking and molecular Dynamics simulations were performed and analyzed the stability during the binding by the root-mean-squares deviation (RMSD), radius of gyration (Rg), root-mean- square fluctuations (RMSF), and number of hydrogen bonds. There were a total of 23 herbs and 963 compounds in the Tamlai Prasumeru remedy. The obtained results indicated that quercetin-3-glucuronide showed an inhibitory effect on the human cyclooxygenase type 2 (COX-2) enzyme. This study can be useful to develop of anti-inflammatory from Thai medicine herbs utilizations in the future.

Keywords: Human Cyclooxygenase type 2, MD simulations, virtual screening

Synthesis of surface modified nanocellulose from biomass for effective capturing of PM 2.5

Papawee Sangiamngam
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand
papawee.sa@ku.th

Thammanoon Thaweechai
School of Integrated Science, Kasetsart University, Bangkok, Thailand
thammanoon.tha@ku.ac.th

Weekit Sirisaksoontorn
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand
fsciwks@ku.ac.th

This research aims to study the synthesis of cellulose nanocrystals (CNC) from rice straw, which is a significant agricultural biomass. This biomass is often disposed by burning, causing air pollution and negative environmental impacts. To address these problems, our research focused on the synthesis of surface-modified nanocellulose for effective capturing of PM 2.5. The nanocellulose was synthesized from rice straw by pretreatment with NaOH, bleaching with H_2O_2 to obtain cellulose long fiber, and hydrolysis with a mixture of H_2SO_4 and H_2O_2, also known as a piranha solution, with a concentration of 50 % v/v. The nanocellulose surface was then functionalized with glycidyltrimethyl ammonium chloride (GTMAC) at a 1:5 mole ratio of AUG (anhydroglucose unit) : GTMAC. Moreover, different sizes of nanocellulose were obtained by centrifugation. The scanning electron microscopy (SEM) analysis revealed that the CNC was a small rod-shaped structure with a decrease in size as the centrifugation increased. The X-ray diffraction (XRD) results showed that the nanocellulose had high crystallinity, making it more resistant to heat. This was consistent with the thermal stability analysis. For the study of PM 2.5 capturing, the results suggested that nanocellulose of all sizes at a concentration of 0.1 % w/v could trap PM 2.5 particles with 99 % efficiency.

Keywords: Rice straw, Nanocellulose, Particulate matter

Synthesis and Fabrication of Electrospun Nanofibers Containing Inclusion Complex of α-Mangostin and Cyclodextrin for Cosmetic Applications

Pattamaporn Ungsumalee*
Kasetsart University, Bangkok, Thailand Pattamaporn.U@ku.th

Kannika Jeamjumnunja Kasetsart University fscikij@ku.ac.th

Alpha-mangostin (α-M) is a major active compound which can be naturally extracted from the pericarb of mangosteens. It is a xanthone compound with numerous biological activities, however, water solubility of α-M is very low which limits the use of α-M in cosmetic applications. The aim of this work is to improve the water solubility of α-M by producing the non-covalent inclusion complex of α-M and hydroxypropyl-beta-cyclodextrin (HP-β-CD). ATR-FTIR results confirmed that the presence of α-M in the synthesized complex compound. The water solubility of α-M in the inclusion complex analyzed using UV-Vis spectrophotometry was about seven times higher than that of the pure α-M compound. The synthesized inclusion complex of α-M/HP-β-CD was then fabricated into nanofibers of polyvinyl alcohol and sacran using electrospinning technique. Sacran is a natural polysaccharide that has been widely used as an ingredient of cosmetic products due to its high water-retention capacity. The surface characteristics and morphology of the obtained nanofibers were analyzed using scanning electron microscopy (SEM) technique. SEM images revealed that the nanofibers were uniform and continuous without beads when using the polymer concentration of 7.5 %w/v incorporated with the α-M/HP-β-CD complex at 20 %w/v of polymer solution. The release of α-M from the nanofibers in water was studied using UV-Vis spectrophotometry. The results showed that the nanofiber sheet of 20% α-M released the high concentration of α-M at 0.0092 mM within 2 min. This study demonstrates a great potential of using these nanofibers containing the inclusion complex of α-M/HP-β-CD for cosmetic application.

Keyword: Electrospinning, Alpha-mangostin, Hydroxypropyl-beta-cyclodextrin, Sacran, Polyvinyl alcohol

Preparation of Biofilm from Agricultural Waste and Metal-Organic Frameworks for Application in Delaying the Ripening of Fruits

Sasina kerdsiri*
Kasetsart University, Bangkok, Thailand sasina.ke@ku.th

Tanwawan Duangthongyou Kasetsart University fscitwd@ku.ac.th

This study examines the extraction of cellulose from agricultural wastes by using palm kernel shells and palm bunches as raw materials, through alkaline treatment and delignification methods. Yields of extracted cellulose were 33.89% and 28.34%, respectively, and XRD analysis revealed crystallinity index values of 69.5% and 65.1%, with crystal sizes of 2.63 nm and 3.53 nm, respectively. The extracted cellulose was then used to synthesize carboxymethyl cellulose (CMC) through alkalization and etherification processes, resulting in yield percentages of 66.17% and 74.60%, respectively.

This carboxymethyl cellulose (CMC) was used in biofilm preparation by mixing with commercial CMC in the ratio of 3:2 and metal-organic framework HKUST-1, with varying amounts of HKUST-1 (0.5g, 1.0g, and 1.5g). They were tested for ethylene adsorption efficiency through gas chromatography. While ethylene adsorption increased with the amount of HKUST-1, the HKUST-1@CMC film was less effective than HKUST-1 powder in ethylene adsorption, possibly due to HKUST-1 particle deformation during the film preparation process and limitation of diffusion of gas molecules in the film. Therefore, further research and improvement of the film preparation method is necessary to create an efficient for delaying fruit ripening.

Keywords: Cellulose, Carboxymethyl cellulose, Biofilm, HKUST-1, Ethylene adsorption

Synthesis Carbon nanomaterials for Bio Sensing Application

Gahnjana Cheysangun
Kasetsart University, Bangkok, Thailand gahnjana.c@ku.th

Patraporn Luksirikul Kasetsart University fscipplu@ku.ac.th

In this work, we prepare the graphitic carbon nanomaterials converted from coconut coirs with a simple method using the activation agents of KOH and Fe catalyst at a certain temperature of 900 °C under nitrogen atmosphere. The combination techniques of Fourier transform infrared (FT-IR), X-Ray diffraction analysis (XRD), and Raman spectroscopy confirmed the structural change from amorphous nanostructures to graphitic nanostructures of our sample with d-spacing of 0.338 nm and the thickness of 8 nm which contained the number of graphitic layers at 24. Our obtained graphitic carbon showed high degree of graphitization at 75.21% and exhibited the better BET surface area of 593 m^2/g compared to the sample of the 900-KOH-CC (BET surface area of 31 m^2/g). This suggested that the presence of activating agents of KOH and Fe at low temperature could produce graphitic carbon nanomaterials from coconut coirs waste. This facile strategy here may introduce a possible methodology and reduce the environmental burden of coconut waste.

Keyword: Coconut coirs, Graphitic Carbon, Biomass

Synthesis of carboxymethyl cellulose hydrogels from biomass for agriculture applications

Sahadsaya Gadsara*
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand
sahadsaya.g@ku.th

Thammanoon Thaweechai
School of Integrated Science, Kasetsart University, Bangkok, Thailand
thammanoon.tha@ku.ac.th

Weekit Sirisaksoontorn
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand
fsciwks@ku.ac.th

Rice straw is an agricultural waste biomass and a by-product of rice farming. However, in Thailand, burning of rice straws is one of the problems that causes an adverse impact on the environment. Therefore, this research aims to utilize rice straws to produce a hydrogel material. Rice straw was initially treated with NaOH and bleached with H_2O_2 to obtain cellulose. Then, the cellulose surface was modified via etherification to produce carboxymethyl cellulose with the variation of cellulose : sodium chloroacetate ratio, 1:1, 1:2, 1:2.5 and 1:3, respectively. Based on the Fourier Transform Infrared Spectroscopy (FTIR) analysis, the results show that there was the peak at a wavenumber of 1587 cm^{-1} denoted as the vibration of the carboxyl group (COOH). This indicates that the hydroxyl group on cellulose was replaced by the carboxyl group after the etherification. For the zeta potential analysis, it was found that carboxymethyl cellulose at 1:2 ratio had the lowest negative zeta potential of -62.63±1.358 millivolt, which was similar to commercial carboxymethyl cellulose (-65.47±1.115). To synthesize hydrogels, as-obtained carboxymethyl cellulose with 4 different ratios was treated with citric acid to form a cross-linking structure. The physical characteristics of hydrogel were studied by using Scanning Electron Microscopy (SEM). The results show that with increasing the concentration of sodium chloroacetate, there were more substitutions of COOH functional groups on the surface of cellulose, resulting in higher cross-linking with a large pore. However, the hydrogel at 1:3 did not form the porous structure. For water content analysis, the results suggest that the hydrogel at 1:2 had the highest water absorption of 98.56% due to the large pore volume. However, the hydrogel at 1:3 could not be tested at the second and third times during the water immersion because the hydrogel became dissolved with water. Moreover, the thermal behavior of hydrogel was analyzed by using Thermogravimetric Analysis (TGA). The results show that the hydrogel at 1:2 had the highest weight loss of 94.487%, which was consistent with the amount obtained from the water absorption analysis.

Keywords: Cellulose, Carboxymethyl cellulose, Hydrogel material, Water absorption.

Comparative study of chemical compositions of hemp seed species

Sitanan Charanja*
Kasetsart University, Bangkok, Thailand Sitanan.char@ku.th

Wanchai Pluempanupat Kasetsart University fsciwcp@ku.ac.th

The FAME analysis on Gas Chromatography Mass Spectrometry (GC-MS) was used in this study to compare the chemical constituents, especially essential fatty acids of the extracts from hemp seed species. After derivatization, eighteen fatty acids were detected with different amounts in each species. The highest total essential fatty acid was found in species KU008. Linoleic acid ethyl ester was the most abundant in all hemp seed extracts, followed by oleic acid methyl ester.

Keyword: Hemp seed, Fatty acid, GC-MS

A study on the utilization of cellulose nanoparticles in the transport of biopharmaceuticals for prophylaxis in aquatic animals

Oatthaphon Ainana*
Kasetsart University, Bangkok, Thailand oatthaphon.a@ku.th

Chaiya Prasittichai Kasetsart University chaiya.pr@ku.th

The cellulose nanocrystals (CNCs) derived from waste agricultural materials have garnered considerable attention for biological transport due to their low toxicity toward cells and their considerably facile surface moderation. In this project, CNCs were synthesized from the biological waste and surface modified with amine decorating group. Characterizations were performed to ensure the complete surface decoration. Stability of synthesized CNCs colloid were tested in several concentrated solutions mimicking the digestive systems of animals. It was found that surface modified CNCs exhibited significantly higher colloidal stability in all ionic solutions. Bovine serum albumin was used to test the biologics loading ability in both CNC and surface modified CNCs. No significant loading difference was found on both CNCs and surface modified CNCs. The results in this report highlight the importance of surface modification of the biologics transport that could be beneficial for the biopharmaceuticals research and other related fields.

Keywords: Cellulose nanocrystals, Stability of colloid, Bovine serum albumin

Heterologous expression of the alternapyrone gene cluster from *Menisporopsis theobromae* BCC 4162 in *Aspergillus oryzae* NSAR1

Inthira Tapeng
Department of Chemistry, Faculty of Science, Kasetsart University
Bangkok Thailand inthira.ta@ku.th

Pakorn Wattana-Amorn
Department of Chemistry, Faculty of Science, Kasetsart University
Bangkok Thailand fscipwa@ku.th

Menisporopsis theobromae BCC 4162 is a fungus containing many cryptic natural product biosynthetic genes, including a polyketide synthase gene responsible for the biosynthesis of alternapyrone. Alternapyrone has a core structure of 2-pyrone or α-pyrone, and this group of compounds displays several biological activities such as anticancer, antiviral, and anti-fungal activities. In this study, the alternapyrone gene cluster was cloned into an expression vector using homologous recombination in yeast and Gateway cloning approaches. The resulting expression vector was then introduced to the heterologous host, *Aspergillus oryzae* NSAR1, for metabolite production. Mycelia were then separated and extracted with acetone, while the culture broth was extracted with an organic solvent mixture containing ethyl acetate/methanol/acetic acid in a ratio of 89.5:10:0.5. The crude extracts were then analyzed using high-performance liquid chromatography (HPLC) technique. The results showed that alternapyrone was found in the crude extracts obtained from the mycelia as previously reported. However, differences in the HPLC chromatograms of the crude extracts were found from transformants containing *mtaltD* encoding cytochrome P450 monooxygenase. This could be a result of modification on the alternapyrone structure catalyzed by MtAltD. Isolation and structure determination of new metabolites obtained from this work will be performed followed by the screening of their biological activities.

Keyword: *Menisporopsis theobromae* BCC 4162, *Aspergillus oryzae* NSAR1, Alternapyrone, Heterologous expression

Preparation of piezo-photocatalytic films ($BiFeO_3$/PVDF/CNC) for organic dye degradation

Praewa Pradubmuk*
Kasetsart University, Bangkok, Thailand prewa.pra@ku.th

Junya Jettanasen Kasetsart University fscijyk@ku.ac.th

In this work, Bismuth ferrite ($BiFeO_3$) were prepared using hydrothermal technique. In order to be utilized in piezo-photocatalysis process more conveniently and to improve the recovering method, the $BiFeO_3$ nanoparticles were incorporated into poly(vinylidene fluoride) (PVDF) which is one of the piezoelectric polymers. Here, the PVDF films were prepared in a glass petri dish by solvent casting method using dimethylformamide (DMF) as solvent. Different concentrations of the PVDF in DMF solvent were studied and the optimum condition was applied for the preparation of $BiFeO_3$/PVDF composite films. The concentration of $BiFeO_3$ in PVDF films were also varied. Furthermore, to improve the mechanical properties of the $BiFeO_3$/PVDF films, cellulose nanocrystals (CNCs) were added into the $BiFeO_3$/PVDF solutions before submitted to casting process. The resulting mixtures were led to dry in an oven at 70°C for 2 hours. Finally, the obtained composite films were peeled from the substrate and their properties were examined.

Keyword: Piezo-photocatalytic, Bismuth ferrite, Polyvinylidene fluoride, Cellulose nanocrystals

CO, CO_2, H_2 and NH_3 Molecular absorption on Hydroxyl Graphene and reaction between CO_2 and H_2 on B – Cu dope Graphene: DFT calculations

PUNJAPOL. MATTHAYOM*
Kasetsart University, Bangkok, Thailand Punjapol.m@ku.th

CHADCHALERM RAKSAKOON Kasetsart University chadchalerm.r@ku.ac.th

Graphene is a two-dimensional carbon material that features a hexagonal lattice structure of atoms. It is composed of a single layer of carbon atoms and is an exceptional conductor of both heat and electricity. Additionally, Graphene is transparent and flexible, making it a suitable material for use in electronic devices. The study of absorption utilizes Density Function Theory to calculate the structure of small molecules and the absorption process. When examining the absorption of small molecules, NH_3 exhibits the most negative absorption energy. When investigating adsorption on Graphene Oxide, the value is -5.42 kcal/mol, while on Graphene Hydroxide, it is -11.51 kcal/mol. When studying the formation of methanol using the reaction between carbon dioxide and hydrogen molecules, Reaction 2 model 1 is the most appropriate because it has the highest activation energy (Ea) value at 54.08 kcal/mol.

Synthesis and Structural Modification of Thymidine Derivatives via Multicomponent Pd-Catalyzed Coupling Reaction

Kamonwan Jaithum*
Kasetsart University, Bangkok, Thailand kamonwan.jai@ku.th

Nutthawat Chuanopparat Kasetsart University fscinwc@ku.ac.th

Thymidine, a natural nucleoside, can be modified structurally to give derivatives, which could show biological activities and have the efficacy as for medicinal uses. This research focused on the synthesis and structural modification of thymidine derivatives via a multicomponent Pd-catalyzed coupling reaction by using aryl halides with the different substituents and nitrogen nucleophile, adamantan-1-amine. This one–pot reaction can be easily used to synthesize various thymidine derivatives. In the future, new synthesized products will be evaluated for interesting biological activities.

Keywords: Thymidine, multicomponent Pd-catalyzed coupling, synthesis, one - pot reaction.

Silver nanoparticles synthesis using lignin extract

Jutatip Navasuwan*
Kasetsart University, Bangkok, Thailand jutatip.nav@ku.th

Pannaree Srinoi Kasetsart University fsciprsr@ku.ac.th

The aim of this study was to synthesize the silver nanoparticles (Ag NPs) by green synthesis method using biomass-extracted lignin as a reducing and capping agent. The extracted-lignin reduce silver ion (Ag^{+}) to form silver nanoparticles (Ag^{0}) and capped at the outermost surface of Ag NPs. The nanoparticles obtained from the reaction were defined as the lignin functionalized silver nanoparticles (Li-Ag NPs). Two different types of lignin, including Para-rubber wood (PRW-lignin) and Palm kernel shell (PKS-lignin), were used in this study. The results from ^{31}P-NMR indicated that two types of lignin had different functional groups in their structures. The synthesis of silver nanoparticles was then investigated under various reaction temperatures, and concentrations of lignin. The formation of Ag NPs was confirmed by UV-vis spectroscopy. The presence of extinction peak of Ag NPs was recorded at 420 nm. The results showed that the concentration and temperature affected the synthesis of silver nanoparticles. The rate of Ag NPs formation increased with increasing temperature and lignin concentration. Additionally, the particle size and zeta potential of Ag NPs were investigated by Dynamic light scattering (DLS). The as-synthesized Ag NPs showed the average size of 10-100 nm and a high negative zeta potential, which indicated the stability of the Ag NPs. Moreover, the antibacterial activity of Li-Ag NPs against *Bacillus cereus, Staphylococcus aureus* as gram positive and *Escherichia coli, Pseudomonas aeruginosa* as gram negative bacteria was also studied and the results suggested that Li-Ag NPs synthesized using both types of lignin had an ability to inhibit all types of bacteria.

Keyword: Silver nanoparticles, Lignin, Palm kernel shell, Para-rubber wood, Green Synthesis

Influence of dopants on structure and piezo-photocatalytic properties of bismuth ferrites

Thanida Klinkhiaw*
Kasetsart University, Bangkok, Thailand thanida.kli@ku.th

Junya Jettanasen Kasetsart University fscijyk@ku.ac.th

In this work, we studied the influence of doping on the structural and piezo-photocatalytic properties of bismuth ferrite ($BiFeO_3$). For this purpose, Samarium (Sm), Neodymium (Nd) or Cerium (Ce) was added into the $BiFeO_3$ structure at different concentrations (2%, 4%, 6%, 8% and 10%). The hydrothermal technique was applied for the doped $BiFeO_3$ synthesis, and methylene blue (MB) was employed as an example of organic pollutants. To examine the piezo-photocatalytic property of the as-prepared samples, the MB decompositions were carried out under UV light with sonication. It was found that, at 4% of dopant, the Samarium doped $BiFeO_3$ offered the highest degradation efficiency (81.46%) followed by that of Cerium (80.89%) and Neodymium (66.45%), respectively.

Keywords: bismuth ferrite ($BiFeO_3$), hydrothermal technique

Heterologous expression of a polyketide synthase gene from *Menisporopsis theobromae* BCC 4162 in *Aspergillus oryzae* NSAR1

Nattapong Dedkad
Kasetsart University, Bangkok, Thailand nattapong.ded@ku.th

Pakorn Wattana-Amorn Kasetsart University fscipwa@ku.ac.th

Polyketide synthases are enzymes used for synthesizing polyketide natural product. In this research, polyketide synthase gene (PKS) from natural product biosynthetic gene cluster from *Menisporopsis theobromae* BCC 4162 was studied. This gene was cloned into an expression vector by using homologous recombination technique in *S. cerevisiae* YPH499 and Gateway cloning approaches. Then expression vector was introduced into the heterologous host, *Aspergillus oryzae* NSAR1, for metabolite production. Then the transformant culture was grown and extracted by separating mycelia from culture broth. The latter was extracted with ethyl acetate. For mycelia, they were soaked in methanol. The crude extracts were analyzed by high-performance liquid chromatography (HPLC) and thin layer chromatography (TLC) techniques. The differences between the crude extracts of transformants carrying PKS gene and control led to the isolation of monomethyl succinate. This compound can induce proinsulin activity in diabetic patients and has antioxidant activity in mitochondria complex. Based on monomethyl succinate structure, this compound is not a polyketide origin and could be a result from the expression of PKS gene studied in this work. This could be further developed for production of monomethyl succinate using biological platform.

Keywords: Polyketide synthase, *Menisporopsis theobromae* BCC 4162, *Aspergillus oryzae* NSAR1, Heterologous expression.

Virtual Screening of anti-cancer from “Wat Khampramong” recipe against Human Survivin Protein

Nonthaphon Plotoon*
Kasetsart University, Bangkok, Thailand nonthaphon.p@ku.th

Supa Hannongbua Kasetsart University, Bangkok, Thailand fscisph@ku.ac.th

The world's population pays a lot of attention to cancer, as it kills people at a high rate every year across the globe. In Thailand, cancer has been the leading cause of death for many decades. Recently, a mechanism for carcinogenesis has been discovered. Human Survivin Protein is one of the enzymes that researchers are interested in targeting, as survivin overexpression has been reported in almost all human cancers. This makes it necessary to speed up the development of drugs that can treat and reduce the mortality rate. Thai herbs are known to prevent and inhibit cancer, and a study was conducted to find the active ingredient in the herbal pharmacopeia namely “Wat Khampramong” that can inhibit the cancer-targeting Human Survivin Protein using computational techniques. This involved simulating the binding between the active ingredient in the herb (ligand) and the protein molecule. The target receptor of interest was optimized for stable structure adjustment, and then analyzed through molecular docking to select the best structure with the highest Gold Score, indicating good binding between the active ingredient in the herb (ligand) and the target protein molecule. Among 1069 compounds found in the recipe, Salvianolic acid E was selected and then analyzed with the target protein molecule (receptor) through Molecular Dynamics (MD) simulations, including RMSD, Rg, RMSF, the number of hydrogen bonds, and cluster analysis at simulation times of 0-100 ns. The obtained results indicated that Salvianolic acid E, found in Cat’s Whiskers in the recipe for medicine from Wat Khampramong, can inhibit Human Survivin Protein.

Keyword: Human Survivin Protein, Thai herbs, Molecular Dynamics (MD) simulations

Fabrication of electrospun gelatin/hydroxyapatite/titanium (IV) dioxide nanocomposite fibrous scaffold and it's application as a coating material for titanium (Ti6Al4V)

Noppasak Rojanasheeva*
Kasetsart University, Bangkok, Thailand noppasak.r@ku.th

Khrongkhwan Akkarachaneeyakorn Kasetsart University fscikwa@ku.ac.th

Bone tissue engineering has developed a selection of biocompatible polymers to coat on metals in order to adjust their with mechanical resistance properties suitable for bone replacement applications. In this work, a fibrous nanostructure of gelatin with embedded hydroxyapatite (HAp) and a surface decoration of titanium dioxide (TiO_2) nanoparticles was fabricated by electrospinning method. Subsequently, the fibers were cross-linked by dehydrothermal treatment (DHT) in order to stabilize the fibers. The prepared scaffold was found to have high porosity which could facilitate the cell adhesion. According to Transmission electron microscopy (TEM) analysis, hydroxyapatite nanorods were found to be embedded in the fibers. Although TiO_2 nanoparticles were not able to be observed under TEM imaging, energy dispersive X-ray spectroscopy (EDX) confirmed the presence of titanium dioxide nanoparticles on the fibers. Furthermore, the compressive strength of scaffolds was found to be two-fold higher after the addition of TiO_2. The biocompatibility of electrospun gelatin/hydroxyapatite/titanium (IV)dioxide nanocomposite fibrous scaffold coated on titanium (Ti6Al4V) bone implants was studied on MC3T3-E1 pre-osteoblasts using the MTT-assay, which was found to significantly increase both cell adhesion and cell proliferation compared to bare Ti implants.

Keywords: Coating material, Hydroxyapatite, Titanium dioxide, Biocompatibility

Scaling up of removal of metal dust contaminated cesium-137

Pathompong Khayaykaew, Wisit Hirunpinyopas
Kasetsart University, Bangkok, Thailand, pathompong.kh@ku.th

Wisit Hirunpinyopas, Kasetsart University, wisit.hi@ku.th

Cesium-137 (Cs-137) with a long half-life (>30 years) causes a great concerns because of deleterious effects on agriculture and stock farming, and human life. It can be stored and spread throughout the body which most of the portions can be collected in the musculoskeletal and bone area with a biological half-life of ca. 70 days. Recently, a Cs-137 contamination incident has occurred in many steel foundries in Thailand, producing Cs-137 contaminated metal dust as investigated by the Office of Atoms for Peace (OAP) Ministry of Science and Technology, Thailand. This occurs from the non-measuring the radioactivity of the scrap metals from various sources before being as raw materials, resulting in the massive of radioactive iron dust after the process of metal foundries. The main chemical composition of metal dust ash is ZnO 35.6 %, Fe_2O_3 33.5 %, CaO 4.55 %, MnO 4.55 %, and Si_2O 2.05 %. In this work Cs-137 was extracted by lixiviation method. The researcher conducted experiments by taking metal dust ash samples contaminated with Cs-137 for extraction various amounts: 100, 250, 500, 750, 1,000, 2,000, and 5,000 grams. After 3 cycles of repeated extraction, The results of the experiment showed that the percentage of radiation dose was reduced by about 40%.

Simulation studies of the assembly of animal albumin with aptamer-graphene quantum dot complex for animal disease aptasensor

Pornpairat Nuchanong*
Kasetsart University, Bangkok, Thailand Pornpairat.n@ku.th

Prapasiri Pongprayoon Kasetsart University fsciprpo@ku.ac.th

Animal health is of utmost importance. In pets, diabetes and kidney problems are difficult and time-consuming to detect and require testing which is not suitable for pets. Aptasensor disease detection kits offer an alternative approach for measuring diabetes and kidney disease biomarkers. Human Serum Albumin (HSA) acts as a diabetes biomarker. Aptasensor was reported to potentially detect HSA biomarkers in humans. Thus, in this work, the possibility of using aptasensor in animals (cat and dog) is investigated. HSA shares high similarities to Feline Serum Albumin (FSA) and Canine Serum Albumin (CSA). Molecular Dynamics simulation (MD) techniques were employed to understand how aptasensor recognizes CSA and FSA by modeling the binding of CSA and FSA to aptamer-graphene quantum dot complex which is the sensing part in an aptasensor. Results show that FSA and CSA can bind to aptamer-graphene quantum dot complex at domains 1 and 3, with lower efficiency than HSA. Nevertheless, further study in actual complicated conditions is crucial to validate the findings.

Keywords: aptasensor, feline serum albumin, canine serum albumin, human serum albumin, DNA aptamer, graphene quantum dot, MD simulations

Multi-roles of rice straw extracted lignin in one-pot synthesis of TiO_2-Ag photocatalyst and its photo degraded products.

Punsachon Jaroensin*
Kasetsart University, Bangkok, Thailand, punsachon.j@ku.th

Pannaree Srinoi, Kasetsart University, pannaree.sr@ku.th

This research focuses on the study of multiple uses of rice straw extracted lignin. The extracted lignin was used as a reducing agent to decorate silver nanoparticles (Ag NPs) on the surface of titanium dioxide (TiO_2) photocatalyst. Thus, the as-prepared TiO_2-Ag photocatalysts have ability to degrade the used lignin via photodegradation process under visible light. Herein, we aim to investigate one-pot synthesis of TiO_2-Ag photocatalyst and photodegradation of the used lignin under visible light. In the reaction, lignin was firstly used as a reducing agent to form Ag NPs, then the used lignin was expected to immediately degraded under visible light in the presence of TiO_2-Ag photocatalysts. The structure of the as-prepared TiO_2-Ag photocatalysts was confirmed by XRD and the result indicated that there were and intensity at peak 38^{o} demonstrate the presence of silver on the photocatalyst surface. Moreover, the thermal stability of TiO_2-Ag photocatalysts were studied by TGA, which demonstrated two-step decomposition. Firstly, the loss of adsorbed water molecules. Secondly, the mass loss between 200 – 400 ^{o}C was due to the lignin on the photocatalyst surface. FTIR spectra confirmed that there was trace amount of lignin left on the surface of TiO_2-Ag photocatalyst. SEM images revealed that AgNPs were dispersed on the surface of the TiO_2-Ag catalyst. In addition, the SEM images revealed that the sizes of TiO_2, TiO_2-2Ag, and TiO_2-4Ag were 55.18, 66.50, and 71.88 nm, respectively. EDX technique demonstrated the silver atom concentration percentage was 1.01%. The surface charge of the TiO_2-Ag photocatalysts was confirmed by zeta potential. The result showed that the surface charge was negative after coating with Ag NPs.

Keywords: TiO_2-Ag photocatalysts, Lignin degradation

Iron-catalyzed graphitization of biomass

Phiraphat Mongkhonfak*
Kasetsart University, Bangkok, Thailand phiraphat.m@ku.th

Patraporn Luksirikul Kasetsart University fscipplu@ku.ac.th

At the present, the exploration of facile yet economical synthesis of graphitic carbon nanomaterials are of particular importance. In this research, biomass waste from palm industry of palm kernel shells (PKS) and empty fruit bunches (EFB)was converted to graphitic carbon nanomaterials using hydrothermal and catalytic graphitization processes with the presence of iron catalysts such as $Fe(NO_3)_3$, $FeSO_4$, $FeCl_2$ and $FeCl_3$, respectively. The structural properties of the obtained carbon materials from PKS were characterized by XRD. It showed the $C_{(002)}$ plane corresponded to graphite with a particle thickness smaller than 5 nm and contained about 12-14 of graphitic layers. At the comparison of iron sources, it showed that an obtained carbon from $FeSO_4$ as a catalyst has the highest degree of graphitization at 110%, while the others were non-graphitized carbon shown in negative shifts of the (002) peak and negative value of degree of graphitization. In addition, the formation of graphitic structure from EFB was confirmed by XRD and Raman spectroscopy. The results showed $C_{(002)}$ with the calculated d-spacing at 0.334 nm indicating to the existence of graphite structure with the greater particle thickness at 59 nm and number of layers at 177. The Raman spectra (I_G/I_D =1) confirmed the vibrations of sp^2 hybridized bonds in graphitic carbon and sp^3 hybridized bonds indicative of defects in the structure. In conclusion, the present work suggested that the presence of iron catalysts ($Fe(NO_3)_3$, $FeSO_4$, $FeCl_2$ and $FeCl_3$,) used in the graphitization process of PKS had played a key role in the interlayer spacing between graphitic carbon layer of resulting carbon materials. We also noted that the catalytic graphitization of EFB could transform to graphite with the presence of $FeCl_3$ at 1000°C. This could be a guideline to develop the synthetic method at low cost but the more characterizations and experiments are required for further studies.

Keywords: Biomass, graphite, Graphitization

The composite MoS_2 and gold nanoparticles for enhanced hydrogen evolution reaction

Piengtawan Rerkmongkol*
Kasetsart University, Bangkok, Thailand, piengtawan.r@ku.th

Wisit Hirunpinyopas, Kasetsart University, wisit.hi@ku.th

Hydrogen (H_2) is clean energy. It is safe for humans and can be used in a wide range of applications. It can be used as fuel in industries, vehicles and helps in generating electricity. In this work, we study hydrogen evolution reaction (HER) by using molybdenum disulfide (MoS_2) due to a stable 2D nanosheet, high efficiency and inexpensive electrocatalysts. MoS_2 nanosheets were used as a support for decorating gold Nanoparticle (AuNPs) and doping single Au atom (sAu) via electrodeposition technique (2, 10, 50 and 100 cycles). The HER catalytic performance was determined. It was found that MoS_2 nanosheets deposited with single Au atom 50 cycles (MoS_2/sAu-50) had the excellent ability to catalyze HER because of the low potential and low slope of Tafel causing good electrical conductivity of both positive ions and electrons. Morever, the stability of MoS_2/sAu-50 was also determined, which found that the catalyst is stable even after 5000 uses for a long periods of time (6 hours). Therefore, the results that the size and amount of gold bonded on MoS_2 nanosheets play an important role in promoting HER catalysis.

Keyword : Gold nanoparticle, Single Au atom, Enhanced hydrogen evolution reaction, Electrodeposition technique

Screen-Printed Electrode from Surface Modified Halloysite for Detection of 2,4,6-trinitrotoluene in the Environment

Monthicha Rattanapinta*
Kasetsart University, Bangkok, Thailand monthicha.ra@ku.th

Chaiya Prasittichai Kasetsart University chaiya.pr@ku.th

2,4,6-trinitrotoluene or TNT is the explosive material widely used in military operation and cement production industry. Since TNT is carcinogenic and residual could be leaking to surrounding areas, proper monitoring of TNT in the environment, especially in the proximity close to TNT containment area, has become crucial, in terms of environmental and safety standards. In this work, amine-surface modified halloysite was incorporated with carbon paste to construct screen-printed electrodes for quantitatively determination of TNT. When TNT was binding with amine-rich surface of halloysite, labile proton on the surface was increased. As a result, the proton conductivity was linearly increased as a function of TNT. This simple notion allow us to develop a calibration curve for TNT detection. Our TNT device could sense TNT concentration in the range of 10^{-7} M to 10^{-4} M, which may be sensitive enough to be used in certain TNT detection operations. Suggestions and route for improvements are reported herein.

Keywords: TNT determination, electrochemical sensor, surface modified halloysite

Preparation of nanocellulose-based hydrogel for selective removal of some heavy metal from water

Mullika Thongruong*
Kasetsart University, Bangkok, Thailand mullika.th@ku.th

Peerada Yingyuad Kasetsart University fscipdy@ku.ac.th

The contaminated wastewater from industrial process may contain toxic substances such as heavy metals and organic dyes. Efficient and convenient removal of these pollutants from water is therefore very important. Among existing methods, adsorption has attracted much attention due to the advantages of high efficiency, simplicity and low cost. In this study, hydrogel composites for effective removal of Cu^{2+} in water were developed. The hydrogels were prepared from carboxymethyl cellulose (CMC) and cellulose nanofiber (CNF), obtained from TEMPO-mediated oxidation of microcellulose (MCC), followed by defibrillation, and glutaraldehyde was used as the crosslinking agent. Inorganic additives such as bentonite (B) can strengthen the hydrogel structure. Addition of poly(vinyl) alcohol (PVA) was found to aid the formation of free-standing hydrogel composites. The prepared hydrogel composites were characterized by Scanning Electron Microscopy (SEM) and Fourier Transform Infrared Spectroscopy (FTIR). The adsorption performance of the hydrogel composites was then examined in various conditions. The result showed that adsorption capacity of the hydrogel composite significantly elevated at pH 5. When the concentrations of Cu^{2+} increased, the adsorption capacity also increased. According to highly porous structure of the hydrogel, the adsorption rate was rapid in the first 15 minutes and then reached the equilibrium. The hydrogel composite demonstrated great reusability with almost no change in adsorption capacity after 3 cycles. In addition, the as-prepared hydrogel composite showed high selectivity in adsorbing methylene blue (MB), a cationic dye, over an anionic dye.

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

Heterologous expression of fungal natural product genes in *Saccharomyces cerevisiae* BJ5464

Vipawee Kaewcompod
Department of Chemistry, Faculty of Science, Kasetsart University Bangkok Thailand
Vipawee.k@ku.th

Pakorn Wattana-Amorn
Department of Chemistry, Faculty of Science, Kasetsart University Bangkok
fscipwa@ku.ac.th

Paecilomyces cinnamomeus BCC 9616 and *Menisporopsis theobromae* BCC 4162 are fungi containing many silent natural product biosynthetic genes. This also includes dictyostelids, *Cavenderia subdiscoidea* and *Cavenderia ungulata,* which contain many silent polyketide synthase genes. Expression vectors carrying nonribosomal peptide synthetase genes (*nrps33* and *nrps63*) from *P. cinnamomeus,* alternapyrone polyketide synthase gene (*mtaltA*) from *M. theobromae* BCC 4162 and type III polyketide synthase genes from *Cavenderia subdiscoidea* and *Cavenderia ungulate* were introduced into *Saccharomyces cerevisiae* BJ5464. Each transformant was cultured and screened for new metabolite production by using high performance liquid chromatography (HPLC). The results showed that metabolites produced by transformants carrying *nrps33* and type III PKS genes were different from controls. Anthranilic acid was isolated from culture carrying *nrps33* whilst metabolites produced from culture carrying type III PKS genes are currently being isolated. This will be followed by structure elucidation using mass spectrometry (MS) and nuclear magnetic resonance (NMR) spectroscopy techniques. Although, it is still unclear whether novel metabolite can be obtained from this work but the method used here could provide a biological platform for metabolite production such as anthranilic acid used in pharmaceutical and food industries

Preparation of modified cellulose using Hydroxypropyl-beta-Cyclodextrin

Siripansa Chenyawanich* and Thitinun Karpkird
Kasetsart University, Bangkok, Thailand Siripansa.c@ku.ac.th

In this project, the cellulose and 2-hydroxypropyl- β-cyclodextrin (HPBCD) surface modification have been done to improve the water solubility and used as drug carrier. First step, nanocellulose was prepared by hydrolysis of cotton in strong acid condition then the oxidation of nanocellulose by sodium periodate was done resulting cellulose dialdehyde. The chemical structure of dialdehyde cellulose was characterized by using FTIR technique. Another part, 2-hydroxypropyl- β-cyclodextrin was modified by tosylchloride then substituted by ethylenediamine resulting HPbCD-NH_2. The cellulose dialdehyde would be condensed with HPbCD-NH_2 resulting schiff base linkage cellulose. These cellulose modification would be applied for encapsulation of the active compounds for cosmetic or drug applications.
Keywords: Nanocellulose, 2-hydroxypropyl-β-cyclodextrin, Schiff base, dialdehyde cellulose

Synthesis of Nitrone-conjugated Dendrimer as Antioxidant Spin Trap

Suthasini Sinanantachai*
Kasetsart University, Bangkok, Thailand suthasini.s@ku.th

Witcha Imaram Kasetsart University witcha.i@ku.ac.th

Alpha-phenyl N-tertiary-butyl nitrone (PBN) is a nitrone-based free radical spin trap that forms a stable nitroxide free radical. This could theoretically bring balance between free radicals and antioxidants level in physiological condition. If the body is out of balance, it can cause a condition known as Oxidative stress. This condition is a process that causes DNA, proteins and cell membranes in the body to become inflamed and damaged. In this work, we are interested in synthesis and developing Nitrone-conjugated dendrimers. We attempted to synthesize a PBN derivative, *N*-tert-butyl-α-(4-carboxy)phenylnitrone, which will be subsequently conjugated with G4 PAMAM dendrimers as a compound and will be tested for free radical trapping property.

Keywords: N-tert-butyl-α-(4-carboxy)phenylnitrone, PAMAM dendrimer, Antioxidant, Spin trapping

One-pot synthesis of dibenzo[*b,f*]azepine derivatives

Sunisa Songatibay*
Kasetsart University, Bangkok, Thailand sunisa.songa@ku.th

Paiboon Ngernmeesri Kasetsart University, Bangkok, Thailand fscipbn@ku.ac.th

Dibenzo[*b,f*]azepine is a polycyclic compound whose structure is similar to those of antidepressant and anticonvulsant drugs such as imipramine and carbamazepine. In this work, we attempted to synthesize dibenzo[*b,f*]azepine derivatives in one pot via a cascade reaction involving nucleophilic aromatic substitution and Knoevenagel condensation. We found that 4-methyl-*N*-(2-methyl-3-nitrophenyl)benzene-sulfonamide could undergo the nucleophilic aromatic substitution reaction with 2-fluoro-5-nitrobenzaldehyde when the reaction was performed with *t*-BuOK as a base in DMF at room temperature to provide bisaryl compound in 74% yield. Attempts to convert this compound to the desired dibenzo[*b,f*]azepine by the Knoevenagel condensation are underway.

Keywords: dibenzo[*b,f*]azepine, one-pot synthesis, Knoevenagel condensation, nucleophilic aromatic substitution,

Concise Synthesis of 1,4-Dideoxy-1,4-Imino-L-Arabinitol (LAB) from D-Xylose via Intramolecular Stereospecific Substitution of -OH Group

Hatairat Promsaka Na Sakonnakhon*
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand
hatairat.pro@ku.th

Sunisa Akkarasamiyo
Department of Chemistry, Faculty of Science, Kasetsart University Bangkok, Thailand
sunisa.a@ku.th

Azasugars or iminosugars are sugar-mimic alkaloids in which an endocyclic oxygen has been replaced by a nitrogen atom. Naturally occurring pyrrolidine azasugars such as 3,4-dihydroxy-2,5-bis(hydroxymethyl)pyrrolidine (DMDP) and 1,4-dideoxy-1,4-imino-D-arabinitol (DAB) showed interesting biological activities. Non-natural pyrrolidine azasugar such as 1,4-dideoxy-1,4-imino-L-arabinitol (LAB) showed stronger glycosidase inhibitory activity than its enantiomer, DAB. This research project aims to develop a greener synthetic method for 1,4-dideoxy-1,4-imino-L-arabinitol (LAB) from a naturally occurring D-xylose which is cheap and abundant. Stereospecific substitution of -OH group without prior derivatization was used as a key step to construct the pyrrolidine ring. LAB was obtained in seven steps from D-xylose with 22% overall yield. Our developed method is a shorter and more environmentally friendly process than the previous reports.

Keywords: dideoxyiminoarabitinol, imino sugars, nucleophilic substitution, phosphinic acid, alcohols.

Studies toward the total synthesis of bauhinoxepin C

Asamaporn Tieojaroenkit*
Kasetsart University, Bangkok, Thailand asamaporn.ti@live.ku.th

Paiboon Ngernmeesri Kasetsart University, Bangkok, Thailand fscipbn@ku.ac.th

At present, cancer is considered a major public health problem in Thailand and its incidence is constantly increasing. Therefore, it is important to find newer and better drugs to treat cancer. Bauhinoxepin C is a natural product whose core structure is dibenzo[*b*,*f*]oxepine. This compound exhibits cytotoxicity against BC cell with IC_{50} value of 32.3 μM and KB cell with IC_{50} value of 44.8 μM. Therefore, the objective of this research is to synthesize bauhinoxepin C from commercially available 2-methylbenzene-1,3-diol. The synthesis of this compound could be achieved in 7 steps. Thus far, only 4 steps, which are 1) fluorination 2) benzylation 3) methylation and 4) formylation, have been accomplished with 11% overall yield.

Keywords: bauhinoxepin C, fluorination, benzylation, methylation, formylation, 2-methylbenzene-1,3-diol

Synthesis and application of Strontium metal organic frameworks

Anchalee Senyasaen*
Kasetsart University, Thailand anchalee.se@ku.th

Ramida Rattanakam Kasetsart University fscirdr@ku.ac.th

Metal-organic frameworks (MOFs) with a fascinating three-dimensional crystalline structure, created by the coordination of metal ions and organic ligands, are promising materials for bone engineering applications as scaffolds that can provide mechanical support, drug delivery, and enhanced cell proliferation. In this study, strontium (Sr) and fumaric acid-derived MOF (SrFum) was synthesized using the solvothermal method. We conducted four different syntheses with varying parameters, including different solvents, either dimethylformamide (DMF):H_2O (1:1) or H_2O, and different initial mixing processes, either with or without sonication. The results showed that SrFum MOF was successfully synthesized as a pure phase from the DMF:H_2O solvent, as examined by single crystal and powder X-ray diffraction techniques. The elemental analysis confirmed the empirical formula for SrFum MOF as $[SrC_4H_2O_4]_n$ and the scanning electron microscopy revealed that the sonication step was responsible for the smaller particle size distribution of SrFum MOF. We also fabricated polycaprolactone (PCL) films incorporated with 0.01-2.0 %w of SrFum and their capability to release Sr^{2+} ions in phosphate buffered saline was investigated for 7 days, in order to demonstrate the potential of SrFum/PCL films as guided bone regeneration membranes. The Sr^{2+} releasing performance of SrFum-incorporated PCL films was compared to $Sr(NO_3)_2$-incorporated PCL films and we found that the incorporation of SrFum with similar particle sizes into PCL films resulted in the sustained Sr^{2+}release due to the steady diffusion of Sr^{2+} from SrFum and degradation of the film.

Keywords: Metal organic frameworks, Strontium, Fumaric acid, Solvothermal method

Low-cost sustainable electrocatalysts of Pd-based alloy/MWCNTs and their applications for Formic acid fuel cells

Samutcha Sindam*
Kasetsart University, Bangkok, Thailand samutcha.s@ku.ac.th

Patraporn Luksirikul Kasetsart Uniersity fscipplu@ku.ac.th

Direct formic acid fuel cells (DFAFCs) have gained enormous attention as one of promising clean energy sources to produce electricity for portable devices and vehicles due to their advantages such as safety, low toxicity, low crossover rate, and high specific energy at low temperatures among all other proton-exchanged membrane fuel cells. However, the cost, durability and catalytic activity of catalysts commonly exist in DFAFCs particularly the anodic formic electro-oxidation. To overcome these problems, the exploration of Pd modified electrocatalysts for formic acid oxidation has been therefore extensively studied. In this study, Pd was chosen to be modified by the Ge metal given as Pd-Ge alloy nanoparticles, then was deposited on multi-walled carbon nanotubes (MWNTs) and used as an electrocatalyst for formic acid oxidation. Our novel heterogeneous catalyst was prepared using a milling-assisted covalent-bonding technique at varying Pd/Ge mole ratios of 1:1 and 1:2, respectively. The structure and phase composition of Pd-Ge alloy/MWCNTs composites were characterized by XRD, Raman, TGA, FTIR, SEM, and TEM/EDS techniques which confirmed the presence and good distribution of Pd-Ge nanoparticles on the carbon nanotube as a support. The formic acid electro-oxidation performance of the Pd-Ge alloy/MWCNTs composite was carried out using cyclic voltammetry. The result shows that Pd-Ge/MWCNTs composite with a Pd-Ge ratio of 1:1 exhibited the superior electrocatalytic performance due to its greater ECSA, higher mass activity, better stability, and higher CO tolerance. These suggested that Ge modified Pd alloy nanocatalyst has made significant improvement in electrocatalytic performance for DFAFCs.
Keywords: Palladium, Germanium, Multi-walled carbon nanotubes, Direct formic acid fuel cells.

DFT Studies on Ring-Opening Reactions of Propylene oxide with Nucleophiles: CH_3CH_2MgBr and NaOH

Supichaya Sangkaew*
Kasetsart University, Bangkok, Thailand supichaya.san@ku.th

Chadchalerm Raksakoon Kasetsart University chadchalerm.r@ku.ac.th

Propylene oxide is a very reactive chemical. It is a volatile liquid. Used as intermediates for a wide range of products. It has an epoxide structural component. Which can react chemically with other substances that have good nucleophile properties the study of the chemical reaction process of Propylene oxide with nucleophiles with CH_3CH_2MgBr and NaOH. Using the Density Functional Theory, the result obtained from the most negative adsorption energy of Propylene oxide and CH_3CH_2MgBr was -22.31 kcal/mol, and the reaction between Propylene oxide and NaOH was the best because the E_a obtained from Calculated at 24.19 kcal/mol with the lowest energy value. It is a reaction with low activation energy that can occur quickly.

Preparation of Hyaluronic acid-PVA-cyclodextrin hydrogel

Kunyalux Stapornpiriyadaj* and Thitinun Karpkird
Kasetsart University, Bangkok, Thailand Kunyalux.s@ku.th

In this research, the hydrogel film contained 6% of hyaluronic acid (HA) – 10% of polyvinyl alcohol (PVA) – 10% of 2-hydroxypropyl-β-cyclodextrin (HPbCD) were prepared. The NaH_2PO_4 at different concentrations of 10%, 20%, 30% mol were used as catalyst for cross-linking process forming F10, F20, F30 films, respectively. The solution of HA-PVA-HPbCD was more continuous heated at 100 °C with different times of 10, 20 and 30 min before forming a film obtained F30-10, F30-20, F30-30 film, respectively. The water solubility of the films was then studied. It was found that increasing the concentration of NaH_2PO_4 and the reaction time caused the decreasing of water solubility of the films due to cross-linking was occurred. The FT-IR showed the signal at 1732 cm^{-1} corresponding to the C=O bond of the ester group from cross-linking process. The TGA and DSC studies showed the least degradation of the constituents in the cross-linking film. In addition, SEM technique showed that the porous characteristics of all films. Therefore, the film F30-30 was used for loading vitamin E. It was demonstrated that vitamin E-loaded HA-PVA-HPbCD films could be prepared and decreased the film's water solubility by cross-linking using NaH_2PO_4 as a catalyst. These results can be applied as a carrier for important substances in cosmetics or drugs.

Keywords: hydrogel film, hyaluronic acid, poly (vinyl alcohol), 2-hydroxypropyl-beta-cyclodextrin, vitamin E

Absorbent Zeolite synthesis from bio-mass fly ash

Kaewthip Karnsanthia
Kasetsart University Bangkok Thailand kaewthip.k@ku.th

Tanwawan Duangthongyou Kasetsart University fscitwd@ku.ac.th

Zeolites, crystalline aluminosilicates, are tetrahedrally connected framework solid based on silica and alumina. The structure possesses channels and cages which are large enough to contain extra-framework cations. It can adsorb other cations of organic molecules by cation exchange, which is a property of zeolites. The synthesis of zeolite is prepared by chemical hydrothermal reaction. The zeolite synthesis was conducted from the ash obtained from burning biomass containing SiO_2 and Al_2O_3 by controlling various conditions, treatment of fly ash from 3 sources: Phatthalung, Thung Song (Nakhon Si Thammarat) and Pattani and directly controls their properties such as different acids (HNO_3, H_2SO_4, HCl) and different concentrations (10, 20, 30%v/v) to study the removal of impurity in fly ash and heating in the synthesis process at different temperatures, i.e. 500, 550 and 600 °C for 1 and 2 hours to obtain zeolite, and The synthesized materials were characterized with respect to FTIR and XRD. By analyzing the obtained data, one may observe the crystallization of the zeolitic phase. The XRD analysis confirms the presence of zeolite in materials obtained.

Keywords: Zeolites, hydrothermal, fly ash

Virtual screening of Thai herbal medicine for Alzheimer disease

Jaruporn Srisarakham*
Kasetsart University, Bangkok, Thailand jarupornsr@ku.th

Supa Hannongbua Kasetsart University fscisph@ku.ac.th

Patchreenart Saparpakorn Kasetsart University fscipnsk@ku.ac.th

At present, 30% of the world's population is affected by Alzheimer's disease (AD). A cause of this disease is proposed to be associated with reducing the level of the neurotransmitter acetylcholine. The binding of acetylcholine with acetylcholinesterase (AChE) leads to the memory and learning loss. Therefore, inhibition of acetylcholinesterase activity is an important target of AD treatment. Currently, an example of approved Alzheimer's drug is donepezil. In addition, the use of the medicinal plant is an alternative for the treatment. In this work, compounds from 21 herbs in Prapchompoothaweep remedy were used to search for AChE by using virtual screening which is a technique in computer-aided drug design. From the literatures, 1102 structures were found. Their three-dimensional structures were built and optimized using quantum chemistry method. Then, their orientations in the binding site of AChE were investigated using molecular docking. The results revealed that Dahuribirin A can bind with the high goldscore of 108.35. After that, the complex between AChE and Dahuribirin A was further investigated using molecular dynamics simulations. The results showed the crucial interactions between Dahuribirin A to the key residues which are Trp86, Trp286, Tyr337, and Tyr341. The obtained results will be helpful to use Dahuribirin A for the development of Alzheimer's drug in the future.

Keywords: Virtual screening, Alzheimer, AChE, Prapchompoothaweep

Simultaneously Electrochemical Determination of Ofloxacin and Ceftriaxone by Using Screen Printed Carbon Electrode

Chonlada Khuntee*
Kasetsart University, Bangkok, Thailand Chonlada.khu@ku.th

Wilai Siriwatcharapiboon Kasetsart University fsciwls@ku.ac.th

Ceftriaxone (CFX) is a synthetic antibiotic in cephalosporin group. Usage of CFX is mostly for treatment of bacterial infections gram positive and negative, such as acute otitis media, bacterial skin infection, osteomyelitis, gonorrhea, urinary tract infections. Ofloxacin (OFX) is a synthetic antibiotic in fluoroquinolones group. Usage of OFX is mostly for treatment of bacterial infections, such as acute respiratory or urinary tract infections. Both of CFX and OFX can treat of bacterial infections; however, the overuse of CFX and OFX results in an accumulation in human tissues and could cause adverse effect. Therefore, it is necessary to monitor the amount of accumulated CFX and OFX. In this research electrochemical determination of CFX and OFX were carried out by Sn/PDDA/CB modified screen-printed carbon electrode (Sn/PDDA/CB/SPCE) by using cyclic voltammetry (CV). The modified electrode showed excellent electrochemical performance, good reproducibility, high stability, great selectivity and a low detection limit (LOD). The LOD of CFX was 2.5320 µM and LOD of OFX was 2.0382 µM. The proposed electrode was applied for the detection of CFX and OFX in a artificial urine and simulated body fluid solution (SBF). The percentage recoveries for the detections CFX and OFX were 100 to 105% and 101 to 109%, respectively, which demonstrated the efficiency of Sn/PDDA/CB modified electrodes for practical use.

Keywords: ceftriaxone, ofloxacin, screen printed carbon electrode

Using the Ashes from Biomass Burning to Extract Potassium Salt Using as Fertilizer

Nawattamon Sombatcharone*
Kasetsart University, Bangkok, Thailand nawattamon.s@live.ku.th

Tanwawan Duangthongyou Kasetsart University fscitwd@ku.ac.th

This study focused on investigating the leaching of salt from ashes. Specifically, the salt leaching factor in ash samples from Pattani was examined to identify the most cost-effective conditions for salt leaching volume of solvent, amount of ash for each leaching and leaching time. The optimal conditions were found to be 40 g of ash in 150 mL of water with a leaching time of 1 hour. This approach was then applied to the salt leaching of ashes from Prachuap Khiri Khan to develop a fertilizer formula by purifying the leached salt. The ash of sample P1 gave the highest amount of salt leaching. Sample P1 was therefore selected for purification of salt by the recrystallization method. It was employed to purify the salt, from recrystallization 5 fractions. It was observed that F1 and F2 (1^{st} and 2^{nd} recrystallized salt) showed the K_2SO_4 phase, while F3-F5 (3^{rd} ,4^{th} and 5^{th} recrystallized salt) showed the KCl phase by using XRD and FT-IR technique. Subsequently, the recrystallization process was simplified to resulting in only 2 fractions, F12 and F345. If collected from 2 fraction, first recrystallized salt (F12) and last recrystallized (F345), From XRD technique it reveals that salt F1,F2,F12 and F3-F5,F345 content the purified phase of K_2SO_4 and KCl, respectively more than 95%. The amount of main salt (K_2SO_4) of F1,F2,F12 and main salt (KCl) of F3-F5,F345 was calculated for $\%K_2O$. It provides about 50% and 60% of K_2O for K_2SO_4 and KCl, respectively. It can be mentioned that the recrystallized salt are suitable for using fertilizer 0-0-50 (K_2SO_4) and 0-0-60 (KCl).

Keywords: Salt from ashes, Leaching, Recrystallization

Improving the performance of silver-based nanosensors for mercury detection

Pavara Silakhao*
Kasetsart University, Bangkok, Thailand pavara.s@ku.th

Junya Jettanasen Kasetsart University fscijyk@ku.ac.th

Today, mercury pollution remains a serious environmental problem. Mercury contamination in ecosystem can causes severe effects to human and animals even at extremely low concentration. Mercury can be found in nature as elemental mercury (Hg0), inorganic mercury (Hg^{2+} and Hg^{+}), and organic mercury (CH_3Hg^{+} and $C_2H_5Hg^{+}$). Therefore, monitoring of mercury in various resources is very important. Currently, several techniques are used to detect mercury, such as AAS, ICP-MS, XRF, and etc., but these technologies must be carried out in laboratories and require expensive equipment. Therefore, in this research, we developed an on-site technique for mercury detection based on the change of solution colour (colorimetric analysis). Here, the silver nanoparticles (AgNPs) were used as sensing probe for Hg(II) detection. To prepare this silver-based nanosensor, cellulose nanocrystal (CNC) and cellulose nanofibril (CNF) were applied as stabilizer. The sensing solutions decolorized after reacting with the Hg(II) solutions and complete decolorization was observed after 500 µM of Hg(II) concentration. The mercury detection began to be observed by naked eye at around 100–250 µM. According to the results, the CNFs are promising to be used for sensing system preparation giving the limit of detection about 3.8 µM.

Keywords: Detection of mercury, Silver nanoparticles, Nanocellulose

Study of isolation of aleuritic acid from seedlac

Pawichaya Yuanyee*
Kasetsart University, Bangkok, Thailand pawichaya.y@ku.th

Wanchai Pluempanupat Kasetsart University fsciwcp@ku.ac.th

Lac is an organic resin secreted by the insect *Kerria lacca* in which seedlac shows the presence of aleuritic acid. It is a good base starting material for the synthesis of perfume chemicals. The objective of this study was to study the method of separating aleuritic acid from seedlac to enhance the percentage of yield and purity. For an optimum condition study, the reflux operation of seedlac within several reaction times, such as 5, 15, 30 and 60 minutes, was evaluated to produce the highest percentage of yield of aleuritic acid. The yield percentage of product was 15%, 12% 13% and 11%, respectively. The results pointed out that the longer reaction time did not affect to enhance the percentage of yield of aleuritic acid; however, its purity was better.

Keywords: Aleuritic acid, Seedlac

Modified fish-scale based biochar towards biophosphate fertilizer

Pachara Sathong*
Kasetsart University, Bangkok, Thailand pachara.sat@ku.th

Ramida Rattanakam Kasetsart University fscirdr@ku.ac.th

Fish scales are biological wastes produced in the food industry and consist mainly of hydroxyapatite (HAp) and collagen fibers. Previous studies have shown that certain ion substitution in the HAp crystal lattice can affect its solubility, making fish scales a potentially valuable source of phosphate fertilizers. In this study, we investigate potassium (K) substitution in the structure of Hap by immersing fish scales in potassium chloride (KCl) solution under varying conditions. The fish scales are then pyrolyzed to produce at 450 °C to produce fish scale biochar (FSBC) and modified FSBC. FE-SEM analysis revealed that the immersion in KCl caused the dissolution of HAp and other minerals in the fish scales, with KCl being absorbed into the scales. XRD, Raman spectroscopy, and FTIR analysis confirmed that the resulting biochar was a carbon/hydroxyapatite nanocomposite with carbonatesubstituted HAp as a component. EDS-SEM analysis further demonstrated that the Ca/P molar ratio decreased, while the WD-XRF and ICP-OES analyses showed that both the produced biochar and modified biochars had similar phosphorus amounts. Additionally, the atomic percentage of K and Cl increased while the percentages of Mg and Sr atoms decreased, indicating the K substitution in the HAp structure. These findings show the potential of fish scales as a valuable source of HAp and demonstrate the possibility of potassium substitution for applications in agriculture and related industries.

Keywords: biochar, fish scale, chemical modification, hydroxyapatite, phosphate fertilizer

Photochemical c-c bond formation for synthesis of naphthoquinone derivatives with antimalarial activity using dithiocarbamate catalyst

Ratchaphon Lertchaiyongphanit*
Kasetsart University, Bangkok, Thailand Ratchaphon.l@ku.th

Witcha Imaram Kasetsart University witcha.i@ku.ac.th

Naphthoquinone is a compound that can be separated from the *Rhinacanthus nasutus* (Linn.) Kurz , Thong Pan Chang , which having variety bioactivity such as Antibiotic, Antifungal, Anti-malarial etc. In this research, we are interested in developing a new synthesis method to produce naphthoquinone derivatives. An important naphthoquinone derivative that has been used in medicine is atovaquone which shows strong anti-malarial activity with low side effect but it is expensive. We are therefore trying to find new synthesis methods for decreasing a cost. We used a dithiocarbamate catalyst which would undergo C-S bond cleavage upon blue light irradiation to generate an alkyl radical which would subsequently be added to an olefin scaffold like naphthoquinone. However, the results showed that adduct from naphthoquinone and alkyl radical was observed.

Keywords: Naphthoquinone, radical reaction

Electrochemical determination of ceftriaxone by using screen printed carbon electrode

Wipaporn Chaipraiweche*
Kasetsart University, Bangkok, Thailand wipapon.c@ku.th

Wilai Siriwatcharapiboon Kasetsart University fsciwls@ku.ac.th

Ceftriaxone (CFX) is a cephalosporin antibiotic. It is used to treat respiratory infections, urinary tract infections and gonorrhea. However, the overuse of CFX may cause resistance and leave residue in the body. Therefore, the detection and quantification of CFX are necessary. In this research, the screen printed carbon electrode (SPCE) was chosen for the CFX detection. The SPCE was modified by Sn/PDDA/CB nanocomposite. The detection of CFX by Sn/PDDA/CB modified SPCE was carried out using cyclic voltammetry (CV) under optimized conditions. The CFX concentrations were detected by the Sn/PDDA/CB/SPCE in the range of 2 to 100 µM. From the experimental results, two ranges of linear correlation of CFX were obtained. The low concentration range from 2 µM to 40 µM showed the linear relation: $y = 0.2343x + 0.9745$ with $R^2 = 0.9992$. The high concentration range from 40 µM to 100 µM showed the linear relation: $y = 0.0966x + 6.6079$ with $R^2 = 0.9965$ along with a detection limit of 1.9256 µM. In addition, the modified electrode was carried out for CFX detection in an artificial urine and simulated body fluid solution (SBF) samples. The percent recoveries were 97% and 101%, respectively, which demonstrated the efficiency of Sn/PDDA/CB/SPCE electrodes.

Keywords: ceftriaxone, screen-printed electrode, tin, PDDA

Comparative study of chemical composition and biological activity of hemp leaves species

Wirunpatch Samaiphoom*
Kasetsart University, Bangkok, Thailand wirunpatch.s@ku.th

Wanchai Pluempanupat Kasetsart University fsciwcp@ku.ac.th

This research aimed to study and compare the chemical composition of hemp leaves and biological activities of the leaves extracts of *Cannabis Sativa* L. Subsp. Sativa in species of PRF1, BU1 and FC1. First, the dried leaves of each species were ground and sequentially extracted using hexane, dichloromethane, ethyl acetate and ethanol, respectively. The chemical compositions of each extract were analyzed by Thin-layer chromatography (TLC) and High performance liquid chromatography (HPLC) method. The results found that the three species of hemp leaf extracts had different chemical compositions. Then, the extracts were examined for their biological activities. The evaluation of antioxidant activity by 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity method found that hexane, dichloromethane, ethyl acetate and ethanol extracts of all three species of hemp leaves showed high potential for antioxidant activity. Furthermore, the evaluation of tyrosinase inhibitory activity with Dopachrome using kojic acid as a positive control found that the ethanol extract of hemp leaves species FC1 exhibited the highest potent inhibition of tyrosinase with an IC_{50} value of 84.45 ppm.

Keywords: *Cannabis sativa* L. Subsp. Sativa, Chemical constituents, Antioxidant activity, Tyrosinase inhibitory activity

Titanium complexes bearing ONN-(phenolate) ligands for the ring-opening polymerization of *rac*-lactide and ε-caprolactone

Suppakan Vongfak*
Kasetsart University, Bangkok, Thailand, suppakan.v@ku.th

Pimpa Hormnirun, Kasetsart University, fscipph@ku.ac.th

In this work, a series of titanium complexes supported by (ONN)-phenolate ligands (**1-12**) were synthesized and characterized by ^{1}H NMR spectroscopy. All titanium complexes were used as catalysts for the ring-polymerization (ROP) of *rac*-lactide (*rac*-LA) and ε-caprolactone (ε-CL). The polymerizations were carried out in toluene at 70 °C. For the *rac*-LA polymerization, all complexes produced atactic polylactide (PLA) with the P_m values in the range of 0.50-0.52. Kinetic studies revealed that the zeroth-order and first-order kinetics in monomer were observed for ROP of *rac*-LA and ε-CL, respectively. In addition, the subtituents on the phenoxy ring and back bone structure were found have a significant influence on the catalyst activity.

Keywords: titanium complexes, ring-opening polymerization, *rac*-lactide, ε-caprolactone, atactic, polylactide

Cellulose-based materials for biologics delivery

Sanphong Khamhom*
Kasetsart University, Bangkok, Thailand sanphong.k@ku.th

Chaiya Prasittichai Kasetsart University, Bangkok, Thailand fscicyp@ku.ac.th

Cellulose-based materials have garnered considerable attentions for potential use as vehicles for biologics or drug delivery due to their low toxicity and surface plethora. In this work, cotton was chemical treated with base and bleaching agent to acquire 2 cellulose-based materials, namely cellulose nanocrystals (CNCs) and cellulose microfibrils (CMFs). The average sizes of CNCs and CMFs, as measured by SEM, were 57.9 nm and 12.8 μm, respectively. These two materials were subsequently further oxidized with 2,2,6,6-Tetramethylpiperidine-1-oxyl, TEMPO to increase surface hydroxyl functional group and offer possibilities for surface functionalization. Tissue-compatible polymeric chitosan was used as example for surface functionalization on CMF and was found to change the surface zeta potential from negative to positive value. All synthesized cellulose-based materials were tested on protein bovine serum albumin (BSA) loading. It was found that CMF modified with chitosan shows a superior BSA loading efficiency compared with other synthesized cellulose-based materials. The results show possibilities of using cellulose-based materials as the green efficient vehicle for drug and biologics delivery in the future.

Keywords: Cellulose nanocrystals (CNCs), Cellulose microfibers (CMFs), TEMPO, Chitosan, BSA, Biologics delivery

Synthesis of piperidine core structure of halofuginone and febrifugine from Boc-D-Ser-OMe

Apichaya Patamapituk*
Kasetsart University, Bangkok, Thailand apichaya.patam@ku.th

Nutthawat Chuanopparat Kasetsart University fscinwc@ku.ac.th

Febrifugine is an alkaloid in a quinazolinone family. This compound could be isolated from the roots and leaves of Chinese medicinal plants belonging to the family *Dichroa febrifuga* and *hydrangea*. These herbs have been used as traditional drugs for treatment of Plasmodium parasites infected or malaria. In this work, a suitably synthetic method for a chiral piperidine ring core structure of febrifugine and halofuginone was developed. The synthesis started from commercially available Boc-D-Ser-OMe. This precursor contains a suitable stereochemistry for the synthesis. In this research, the diene intermediate, which could be converted to the piperidine ring, was synthesized in 7 steps with 8.29% overall yield. The key feature of this work was a ring closing metathesis of the diene intermediate to provide the piperidine ring.

Keywords: Febrifugine, Malaria**,** Synthesis, Ring closing metathesis.

The composite $MoSe_2$ and gold nanoparticles for enhanced hydrogen evolution reaction

Arnittaya Leuanrod, Wisit Hirunpinyopas
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand

Hydrogen has been identified as a renewable energy which facilitates the development of green power generation. This is due to its high energy capability, low toxicity, long-term viability, and renewability. In this work, we prepared electrode with electrochemical techniques using gold nanoparticles (AuNPs) deposited on 2D-$MoSe_2$ nanosheets and doping of single gold atom (sAu) on 2D-$MoSe_2$ nanosheets via electrodeposition technique for enhanced hydrogen evolution reaction (HER). The physical characterization and catalytic properties of the catalysts ($MoSe_2$/AuNPs, $MoSe_2$/sAu) were investigated. It was found that electrodeposition of sAu on $MoSe_2$ using 50 cycles ($MoSe_2$/sAu-50cycles) showed excellent catalytic activity due to low over potential. Moreover, we also examined the stability of the $MoSe_2$/sAu-50cycles. The as-prepared catalyst is still functional after 5000 usages. Therefore, the effect of size and amount of gold plays an important role in the rate of electrocatalytic HER.

Computational studies of the binding ability of Brazilin from *Caesalpinia sappan* to SAR-CoV-2 proteins.

Sukritta Janprakhon*
Kasetsart University, Thailand sukritta.jan@ku.th

Prapasiri Pongprayoon Kasetsart University fsciprpo@ku.ac.th

The Coronavirus disease (COVID-19), a global pandemic, is caused by the severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2). Currently, there is no specific treatment available to combat COVID-19. Novel drug repurposing and the identification of natural bioactive molecules are crucial. In this study, we examined the inhibitory effects of Brazilin, a bioactive compound from sappan wood (*Caesalpinia sappan*), on four key SARS-CoV-2 proteins, including main protease (Mpro), spike (S) protein, and RNA-dependent RNA polymerase (RdRp). These proteins play vital roles in various stages of viral replication. Molecular docking and Molecular dynamics (MD) simulations were performed to explore the binding affinity of Brazilin to these target proteins. Brazilin shows the highest binding affinity to RdRp by interacting with critical residues at the catalytic center and NTP entry channel. We then employed Molecular dynamics (MD) simulations to predict the structural stability and dynamics of RdRp-RNA complexing with Brazilin. These findings highlight the therapeutic potential of Brazilin against COVID-19. However, further in vitro and in vivo studies are needed to validate these results.

Keywords: Brazilin, COVID-19, RdRp, Molecular docking, Molecular dynamics.

Checked the information.

Studies toward the total synthesis of bauhinoxepin D

Wiradet Siri*
Kasetsart University, Bangkok, Thailand Wiradet.s@ku.th

Paiboon Ngernmeesri
Kasetsart University, Bangkok, Thailand fscipbn@ku.ac.th

The objective of this work was to synthesize bauhinoxepin D, a natural product found in the roots of *Bauhinea purpurea* L. This natural product contains dibenzo[*b*,*f*]oxepine as a core structure. It exhibits anticancer activity against BC skin cancer cells and KB oral cancer cells. We planned to synthesize bauhinoxepin D from 2-methylbenzene-1,3-diol in 7 steps. Initially, this diol was converted to 5-(benzyloxy)-2-fluoro-3-methoxy-4-methyl benzaldehyde in 4 steps with 13% overall yield. This benzaldehyde was then underwent a cascade reaction involving nucleophilic aromatic substitution and Knoevenagel condensation when it was treated with 2-methyl-3-nitrophenol in the presence of K_2CO_3 as a base in DMF at 160 °C. Although this reaction could provide the desired product, purification was still problematic. Therefore, the yield of this step could not be reported.

Keywords: dibenzo[*b*,*f*]oxepine, bauhinoxepin D, nucleophilic aromatic substitution reaction, Knoevenagel condensation reaction.

Smart sensing for food freshness

Panyapat Kraiseekach*
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand. panyapat.kr@ku.th

Sutasinee Kityakarn
Department of Chemistry, Faculty of Science, Kasetsart University, Bangkok, Thailand. sutasinee.k@ku.th

Meat is a food that has been a favorite consumption. However, preserving the meat before cooking is a problem, and the spoilage of meat releases volatile organic compounds (VOCs) such as ammonia (NH_3). Ammonia gas can be detected with titanium dioxide. Therefore, we have fabricated sensors to indicate fresh meat with two-dimensional- and three-dimensional-titanium dioxide sensors (2 D-TiO_2 and 3 D-TiO_2) and particles titanium dioxide sensor. Graphene oxide (GO) and polymethyl methacrylate (PMMA) were used as a templates to synthesize 2D- and 3D-TiO_2. The physical and chemical characterizations of 2 D-TiO_2 and 3 D-TiO_2 by x-ray diffractometer (XRD) and Raman spectroscopy. The results presented the anatase phase of the 2D-TiO_2 and the 3D-TiO_2 and the vibrational of Ti-O bonds was observed. The SEM images of the 2 D-TiO_2 samples showed the nanosheet of TiO_2-like-graphene oxide (GO) sheet and some TiO_2 particles, and the 3D-TiO_2 images showed the three-dimensional structure with mesoporous and macroporous. The average diameter of the 3 D-TiO_2 structure is estimated from the high magnification SEM image to be 331.4 nanometers. The Fourier transform Infrared (FT-IR) spectrum of the 2 D-TiO_2 and 3 D-TiO_2 samples showed a range of 420 to 440 cm^{-1} associated with the stretching of the Ti-O bond. The thermal analysis of the 2D-TiO_2 and 3 D-TiO_2 samples revealed the decomposition of the graphene oxide (GO) and polymethyl methacrylate (PMMA) templates. The ammonia sensor performance was studied at a concentration of 3 ppm. The 3D-TiO_2 sensor provided the highest sensitivity and the particles TiO_2 sensor had the shortest response and recovery time.

Keywords: Two-Dimensional Titanium Dioxide, Three-Dimensional Titanium Dioxide, Gas sensor, Ammonia.

Coordinates transformation method for pointer gauge reading by machine vision

Teerapat Thongkong*
Kasetsart University, Bangkok, Thailand teerapat.thon@ku.th

Noparit Jinuntuya Kasetsart University fscinpr@ku.ac.th

In this project we present a machine vision system for pointer gauge reading based on coordinates transformation. Since a pointer gauge is a polar representation of a linear scale, it is possible to transform its polar reading to the original linear counterpart. Once the picture of a pointer gauge is captured digitally, we can assign the polar positions to each pixel of the image. Those polar coordinates can be plotted on a rectangular frame to form a transformed image. The scale lines and the pointer are transformed to point vertically (or horizontally). Locations of the scale lines and pointer can be obtained from their pixel histograms maxima. An advantage of our algorithm is that we can avoid the complication of the conventional algorithm, e.g., Hough transformation, to find the orientation of pointer and scale lines. We also integrate our vision system to the analog dial-gauge calibrator developed at National Institute of Metrology, Thailand. A raspberry pi unit equipped with a CCD sensor is used as the vision and processing system. A micrometer head and stepping motor are used, according to JIS B7503: 2017, are used to drive the calibrator. We find that our system can reduce the calibration time with the factor of three. It can also reduce the human error occur in the manual calibration process.

Keywords: Machine vision, Coordinates transformation**,** Pointer gauge**,** Calibration.

Investigation of cis-trans mechanism of azo-based liquid crystal droplets under UV irradiation

Suchapan Makaew,
Department of Physics, Faculty of Science, Kasetsart University, Bangkok, Thailand
suchapan.m@live.ku.th

Nattaporn Chattham Department of Physics, Faculty of Science, Kasetsart University, Bangkok, Thailand nattaporn.c@ku.ac.th

Liquid crystals were first discovered in 1888. Since the time of discovery, Scientists have continuously investigated their properties for applications. Liquid crystals are phases between solid and liquid. They possess physical properties that depends on types of liquid crystals and structure. The cis–trans chemical transformation process of azo liquid crystal was studied using ultraviolet radiation and we applied optical tweezers with circularly polarized light to nematic liquid crystal system. Optical tweezers are magnificent tools for microscopic manipulation. Owing to few piconewton noninvasive trapping force, the tiny objects from micro sand beads down to living bacteria can be trapped under optical tweezers system. Liquid crystals (LCs) are materials that enriched of optical properties providing various phenomena that can be applied for technology. In this report, we applied optical tweezers to nematic liquid crystal system for the optical manipulation study of liquid crystal droplet. 5CB (4-cyano-4'-pentylbiphenyl) was used with an appropriate surfactant to prepare nematic liquid crystal (NLC) droplets at room temperature. NLC droplets in radial and bipolar configurations can be formed. They react with light angular momentum and reveal dynamic and static changes through spinning and changing of internal configuration of nematic liquid crystal (NLC) droplets by ultraviolet irradiation.

Keyword : optical tweezers; angular velocity; nematic liquid crystal droplets; laser polarized light; ultraviolet radiation, cis-trans

Construction of Helmholtz coil and magnetic field profile measurement

Pumipat Tanasirirungroj*
Kasetsart University, Bangkok, Thailand pumipat.tan@ku.th

Jarin Osaklung Kasetsart University jarin.o@ku.th

The Helmholtz coil is a very basic device in almost all scientific instruments that it is necessary to produce a homogenetic magnetic field between the coil. The study of Helmholtz coil fabrication and magnetic field profile measurements has been studied in this project. The experimenter constructed a magnetic field kit consisting of an acrylic base design for the coil placement and a method for measuring the magnetic field along the axis of the coil using two sensors; a Hall effect sensor and a Fluxgate current sensor. The parameter of this project are diameters of the coil core/radius of the coil core of different sizes, consisting of a coil with a radius of 7.5 centimeters, the number of turns of the coil 2000 turns, a coil of a radius of 7.5 centimeters, the number of turns of the coil 30 turns and a radius of 4.5 centimeters, the number of turns 15 turns of the coil, including design and construct Helmholtz coils. To create a magnetic field value that is approximately closest to the Earth's magnetic field as possible. which can be produced at $1.45 \times 10^{-3}\,T$, $1.40 \times 10^{-3}\,T$, $5.94 \times 10^{-4}\,T$, $6.23 \times 10^{-4}\,T$
In addition, the experimenter has studied the development of an Arduino circuit used as a voltmeter to apply as a sensor to measure the magnetic field value for the Fluxgate current sensor

Keyword: Helmholtz coil, Hall effect sensor, Fluxgate current sensor, Arduino

Synthesis of Azolla-based carbon quantum dots for stimulating agricultural plant growth

Kingchat Boonmepipit
Department of Physics, Faculty of Science, Kasetsart University, Bangkok, Thailand
Kingchat.b@ku.th

Weerapat Pon-On *
Department of Physics, Faculty of Science, Kasetsart University, Bangkok, Thailand
fsciwpp@ku.ac.th

Using materials to enhance crop production has been much attention in plant research. Herein, biocarbon quantum dots (BioCQDots) was obtained by the hydrothermal method with Azolla/Water Fern without any surface passivating agent. The present BioCQDots showed □5 nm average size and exhibited strong blue luminescence around 4 4 0 nm under UV light irradiation. Ensure crop growth under BioCQDots treatments, we found that the BioCQDots had a dose effect relation on seed germination and on growth of tomato seed. Results show that the germination rate of tomato seeds treatment with BioCQDots was not affected by increasing the dosage from 5 to 50 μgmL-1. In addition, we found that BioCQDots could accelerate 1.05-1.18 times seed germination rate compared with the control group (water). These findings exhibit great potential of BioCQDots as agents for seed germination and seedling development in a cost-effective and sustainable manner. However, in-depth investigations of the effect of BioCQDots on such biosafety or tomato in growth stage which requires further studies.

Keywords: Carbon quantum dots, light conversion, foliar application, photosynthesis, plant growth

Magnetocaloric Effect in $Ni_{50}Mn_{33}In_{16}Cr_1$ alloy prepared by induction melting technique

Norapon Dechdamrong
Department of Physics, Faculty of Science, Kasetsart University,
Bangkok, Thailand norapon.d@ku.th

Pongsakorn Jantaratana
Department of Physics, Faculty of Science, Kasetsart University,
Bangkok, Thailand fscipsj@ku.ac.th

The $Ni_{50}Mn_{33}In_{16}Cr_1$ alloy was synthesized by induction melting. Phase formation, microstructure and magnetocaloric effect of the samples were evaluated using X-ray diffraction (XRD), scanning electron microscopy (SEM), and vibrating sample magnetometry (VSM), respectively. The magnetic entropy change was calculated from isothermal magnetization measurements under an applied magnetic field of 10 kOe. After induction melting with current 800 A for 150 s, the dominate peak of Heusler alloy phase was formed. The maximum magnetic entropy change (ΔS_M) of 1.50 J/kg·K was observed for the sample melted by current 800 A for 150 s. The substitution of Cr for Mn shifted the maximum entropy change close to room temperature.

Keywords: Magnetocaloric, Induction melting, Heusler alloy, Entropy change

Energy Conversion in space plasma Observed by Magnetospheric Multiscale (MMS) spacecrafts.

Kantachat Tangjittanom[1*]
Peera Pongkitiwanichakul[1]

[1]Kasetsart University, Bangkok, Thailand
kantachat.ta@ku.th
peerious@gmail.com

The process of energy conversion between electromagnetic fields and plasmas in space is not yet fully understood. The behavior of this process is strongly influenced by the presence of mechanisms such as turbulence or plasma instability. To gain a better understanding of this process, we can gather data from the Magnetospheric Multiscale (MMS) Mission, which allows us to study energy conversion in space near the earth. By exploring the role of various factors such as curvature drift, gradient drift, particle inertia drift, and perpendicular magnetization currents in energy conversion, we aim to shed light on the mechanisms of perpendicular electromagnetic energy conversion. Through our analysis of the data obtained from the MMS mission, we hope to enhance our understanding of the energy conversion process in space.

Keyword: Plasma, Turbulence, Energy Conversion, MMS, Earth's magnetosphere

Low Alfvénicity study in solar wind using Parker Solar Probe's data

Natthamon Khrongthong*
Kasetsart University, Bangkok, Thailand Natthamon.khr@ku.th

Peera Pongkitiwanichakul Kasetsart University Peera.po@ku.th

Alfvénicity is a property that describes the degree of correlation between magnetic and velocity fluctuations in the solar wind. The level of Alfvénicity in the solar could be associated with changes in space weather that have a significant impact on the planets of the solar system. Investigating this phenomenon can provide a better understanding of the mechanism of solar corona heating and the acceleration of the solar wind. In this study, we examined and analyzed the time intervals during which the level of Alfvénicity is low using in-situ data obtained from the Parker Solar Probe (PSP), which enabled us to study this property closer to the Sun than ever before. We used the 2nd-order structure functions of magnetic and velocity increments to quantify the degree of Alfvénicity. Our findings indicate that Alfvénicity can be influenced by variables such as the structure of the magnetic field, including the heliospheric current sheet (HCS), which is associated with reduced Alfvénicity. In addition, we found that regions closer to the sun have high Alfvénicity, while regions farther from the Sun have low Alfvénicity.

Keywords: Plasma, Solar wind, PSP

Preparation of copper film on glass substrate by RF sputtering

Tassanee Prasitdacha
Kasetsart University, Bangkok, Thailand, tassanee.pr@ku.th

Watcharee Rattanasakulthong*, Kasetsart University, fsciwrr@ku.ac.th

The copper (Cu) film with different sputtering times was deposited on the glass substrate. Sputtered Cu film was heated treatment at 300^{o}C for 60 min in an air atmosphere. Cross-section images from SEM revealed the thickness was 109, 125, 163, 236, and 298 nm. XRD results indicated that all as-deposited films showed the Cu (111) phase, and its intensity increased with increasing thickness. Additionally, Cu (200) phase existed on film at 163, 236, and 298 nm thickness. After heat treatment, all annealed films exhibited CuO (111) and Cu_4O_3 (202) phases, whereas the Cu_2O (111) and $Cu_{64}O$ (044) phases. The Cu_2O (220) phase was found only at a thickness of 298 nm. AFM results showed that the surface morphology of the sputtered Cu films was thickness dependent. The surface roughness of annealed film was increased with increasing thickness. In addition, the grain size tended to increase with increasing thickness. The results inferred that the heat treatment increased surface roughness and oxidation phases of the Cu films with increasing thickness.

Keywords: Copper film, RF sputtering, heat treatment, and phase structure

Preparation of Al-doped ZnO film on KAPTON substrate by RF-sputtering

Thimada Woraporntassana
Kasetsart University, Bangkok, Thailand thimada.w@ku.th

Watcharee Rattanasakulthong* Kasetsart University fsciwrr@ku.ac.th

The Al-doped ZnO (AZO) film was deposited on a Kapton substrate by RF-sputtering at different times. SEM images reveal that the average thickness of the prepared films was 82–328 nm. XRD results showed that the prepared films exhibited the ZnO phase in (002), (103), and (004) directions, and their intensity of the (002) peak increased with film thickness. For surface morphology from AFM results, grain is formed spherically, and the grain size becomes larger as the coating time increases. The film roughness was slightly increased with increasing thickness. SEM results showed a tendency for the film to have a greater adherence direction. The results of the optical analysis confirmed the constant values of light absorption and transmittance in the visible wavelength at various thicknesses. The electrical resistance tends to decrease with increasing film thickness. The results inferred that the phase structure and surface morphology of sputtered AZO film on Kapton substrate are thickness dependent.

Keywords: AZO films, Thickness, RF sputtering, and Kapton substrate

Quantum monitoring path of energy transfer in light-harvesting of the plant in the photosynthesis process

Teerapat Uthailiang
Department of Physics, Faculty of Science, Kasetsart University,
Bangkok, Thailand teerapat.ut@ku.th

Sutee Boonchui*
Department of Physics, Faculty of Science, Kasetsart University,
Bangkok, Thailand fscistb@ku.ac.th

The photosynthesis process It is the important that allows life to live in the world by using energy from sunlight converts carbon dioxide (CO_2) and hydrogen from water (H_2O) or other hydrogen sources into carbohydrate compounds and oxygen (O_2) is produced. There is a continuous energy transmission mechanism on the pigments in the chloroplasts which describes the mechanism in a classical. In this project, the quantum mechanism is described to demonstrate the factors affecting the efficiency of photosynthesis. By studying the energy transmission pathway on the pigment to the reaction center. Thus, the study of the spin system, which is similar to the photosynthesis system, was started. By considering decoherence and analyzing it through path integral. This will result in a partition function with a Lagrangian. Then the Lagrange's mechanics in Path Analysis and a model of the spin-to-photosynthetic system was used as a two-level system. The results suggest that changes in both the spin and photosynthesis systems can be altered due to environmental effects. In the absence of effect, the system environment will not change. But it will be in a certain state or cannot be identified. As a result of the environment, a system at one state dynamically changes and changes to another state. which shows that if the environment changes or there is interference from the outside to change the system. It provides an understanding of the factors affecting photosynthesis that change the process of energy transfer within chloroplasts. which is a measure of the efficiency of photosynthesis to increase the efficiency of the photosynthesis process can be used to accelerate plant growth. and further developed to be used in analyzing agricultural work.

Keywords: The photosynthesis process, Energy transfer, Path integral, Decoherence

Relativistic motion of an under a constant force

Pacharapol Kwanbang
Kasetsart University, Bangkok, Thailand Pacharapol.kw@ku.th

Noparit Jinuntuya*, Kasetsart University, fscinpr@ku.ac.th

We perform thought experiments to investigate how the relativistic length contraction occurs when an object moves under a constant force. Consider a rod is accelerated in the direction along its length by a constant and homogeneous distributed force. Initially the rod is at rest with respect to an observer S. The other observer S' moving with speed u relative to S in the same direction to the rod also investigates the motion of this rod. When the rod gains the speed u, the force is shutdown, and the rod continues moving with the constant speed u relative to S. At this final state the rod is at rest with respect to S'. We consider two cases, where the force is applied simultaneously to every points of the rod, first with respect to S, and second with respect to S'. We find that what happen to the rod are different. In the first case S will see no change to the length of the rod, while for S' the rod is expanded. There is no "contraction" for any observers. In the second case S' will see the rod with a constant length, while S will see the contraction. Even though the results of these two cases are different, they agree well with the length contraction formula. The "contraction" must be interpreted carefully, since, as well as all relativistic phenomena, it is relative.

Keywords: Relativistic motion, Length contraction, Simultaneously

Synthesis and Characterization of Al-Mn_3O_4-rGO nanocomposite

Pontagarn Chanpuang, Sirikanjana Thongmee
Kasetsart University, Bangkok, Thailand Pontagarn.c@ku.th

Sirikanjana Thongmeea[a] Kasetsart University fscisjn@ku.ac.th

In this work, Al- Mn_3O_4 and Al- Mn3O4-x%rGO (x = 5, 10, 15) nanoparticles were synthesized by reflux method. X-ray diffractometer, Scanning electron microscope and ultraviolet-visible spectroscopy were used to characterize all samples. The X-ray diffraction patterns showed only peaks of Al- Mn_3O_4 and no reduced graphene oxide (rGO) peak appeared. The crystallite size of all samples was not different. The scanning electron microscopy images investigated that Al- Mn_3O_4 nanoparticles were distributed on the surface of reduced graphene oxide sheets. It can be clearly seen the reduced graphene oxide sheets. Furthermore, the energy band gap of the Al-Mn_3O_4 and Al- Mn_3O_4-x%rGO were 2.12, 2.1796, 2.1347, and 1.8489 eV, respectively. These results showed that the energy band gap decreased with the increasing of reduced graphene oxide. From this work, Al- Mn_3O_4 and Al- Mn_3O_4-x%rGO were used to test photocatalysis. The result showed that Al- Mn_3O_4 and Al- Mn_3O_4-x%rGO have the efficiency to remove dyes from the wastewater.

Keywords: graphene oxide, manganese oxide, photocatalysis, dye

Modified velocity model for inspection of defects in teak wood by ultrasonic time of flight

Sasitorn Thongkiat
Kasetsart University, Bangkok, Thailand Sasitorn.tho@ku.th

Noparit Jinuntuya*, Kasetsart University, fscinpr@ku.ac.th

This project is a continued work aimed to use the ultrasound to detect the decays in teak wood. We replace the piecewise linear velocity model used in the previous work with the established Hankinson's formula. The ultrasonic waves are sent through the regtangular wood samples. The signals are collected and analyzed by an ultrasound analyzer to obtain the time of flight (TOF), which is defined as the time when the signal rises above the noise. The parameters of the Hankinson' formular are obtained by minimizing the root-mean-square error of the measured and calculated TOF. For a healthy wood, the uncertainty of the TOF can be as small as 10 microseconds, indicating that the model fits with the measurement quite well. To see the effect of the decays, we do a simulation by drilling a hole on a wood sample. The TOF differs significantly from the values measured before drilling. This time difference can be used to inspect the decay in the wood.

Keywords: Hankinson's formula, time of flight (TOF), and root-mean-square error

Leptonic Spectral Energy Distribution Emission of Nearby Pulsar Wind Nebulae from Multi-Wavelength Observations

Supphakit Wiweko[1*]
Brandon Khan Cantlay[1]
Maneenate Wechakama[1]

[1]Kasetsart University, Bangkok, Thailand
supphakit.w@ku.th
brandonkhan.can@ku.th
maneenate.w@ku.th

As one of the largest very-high-energy γ -ray sources in the Galaxy, pulsar wind nebulae (PWNe) are created by the interaction of pulsar winds with the remnant from supernovae explosion. These pulsar winds are composed of high-energy particles and magnetic fluxes and are powered by the central rotation-powered pulsars. This work is interested in leptonic spectral energy distribution emission of nearby PWNe from radio to gamma ray wavelength. We focus on the well-known pulsars such as Vela pulsar, Geminga pulsar, and Crab pulsar. To study the leptonic spectral energy distribution emission we prepare data by selected data detected by Fermi-LAT in the energy range from 100 MeV to 300 GeV and bin data in each energy range to calculate spectral energy distribution of photons. Furthermore, we use spectral energy distribution of photons detected by several observations such as Hubble space telescope in wavelength ranges from near infrared to ultraviolet, Spitzer Space Telescope in infrared wavelength etc. We then perform leptonic spectral energy distribution emission models to compare with observed data. In this model we consider non-thermal radiation such as synchrotron radiation, and inverse Compton scattering. Finally, we provide the best-fit of the spectral energy distribution of leptons for the nearby pulsar wind nebulae.

Keywords: Pulsar wind nebulae, Pulsar, Non-thermal radiation, Synchrotron radiation, Inverse Compton scattering.

Preparation of Carbon film on Glass substrate by RF-Sputtering

Chonticha Wannasiri
Department of Physics, Faculty of Science, Kasetsart University, Bangkok, Thailand
Chonticha.wanna@ku.th

Watcharee Rattanasakulthong *
Department of Physics, Faculty of Science, Kasetsart University, Bangkok, Thailand
fsciwrr@ku.ac.th

Somruedee Sakkaravej
Department of Earth Sciences, Faculty of Science, Kasetsart University, Bangkok, Thailand
fscisrd@ku.ac.th

This research prepared Carbon film deposited on a glass substrate by RF-sputtering method. To study the properties of films that different coatings, which from the properties of the film are obtained in different thicknesses (44, 56, 80, 92, and 182 nm). The coating rate is approximately 31.3 nm/min. The XRD results indicated that the deposited and annealing carbon film represents the entire amorphous phase. The Raman spectrum confirms the carbon nanotube film on a glass substrate with as-deposited films the Raman shift at 1600 and 1100 cm^{-1}, except the 44 nm film shows the Raman shift only at 1100 $cm^{-1}$and annealing films the Raman shift at 1600 and 1100 cm^{-1}, except the 44 nm, 56 nm, and 80 nm film shows the Raman shift only at 1100 cm^{-1}. The AFM result shows the spiculate structure of the as-deposited and annealing film surface with different sizes and shapes. The highest and lowest surface roughness is observed on the 44 and 56 nm films. In addition, the 56 and 80 nm films exhibit smooth surfaces, corresponding to the surface result from the SEM. In addition, the optical transmission properties of the as-deposited films, the highest and lowest transmissions of 70.90% and 62.81%, are observed on the 56 and 44 nm films, respectively. In the annealing film, the highest and lowest transmissions of 73.17% and 58.96% are observed on the 44 and 182 nm films.

Keywords: Carbon nanotube (CNT) thin films, sputtered film, a glass substrate, a sputtering technique.

Combined laser triangulation and autocollimator with a common light source

Areeya Srisakorn*
Kasetsart University, Bangkok, Thailand areeya.sris@ku.th

Noparit Jinuntuya Kasetsart University fscinpr@ku.ac.th

In this project we demonstrate a prototype of combined laser triangulation and autocollimator. A laser beam is split into two beams by a beam splitter. One beam is aligned perpendicular to the reference plane attached to the sample holder. This beam is used as a light source of an autocollimator. Another beam is aligned with an angle to the reference plane. This beam is used as a light source of a laser triangulation system. The system can be used as an optical non-contact device to measure the thickness and surface inclination of a sample simultaneously. This can reduce the measuring time and possibility of sample damage due to the transportation of a sample if the measuring modes are operated separately. Two raspberry pi units with CCD cameras are used to capture the measured images. With the pixel size of 1.12 um × 1.12 um and 1.55 um × 1.55 um, we can achieve the resolutions of the autocollimator and laser triangulation to be 0.00033 degree/pixel and 0.93 micron/pixel, respectively

Keywords: Laser Triangulation, Autocollimator, non-contact measurement.

Hardness Removal in Groundwater by Synthesis of Kaolinite-Based Zeolite.

Yosawadee Hirunkhan*
Kasetsart University, Bangkok, Thailand yosawadee.h@ku.th

Kannaree Chuangcham Kasetsart University fsciknr@ku.ac.th

Sasithorn Khonthon Rajabhat University sasithorn@pnru.ac.th

Hardness refers to water containing calcium ions and magnesium ions dissolved. Hard water can cause problems with reduced soap lathering, increased pipe scaling, and reduced water heaters efficiency. This study aims to study the ability of zeolite from Ranong kaolin and Lampang kaolin to absorb calcium in groundwater. The synthesized zeolite is characterized by scanning electron microscopy (SEM) and Surface area and porosity analyzer (BET). According to BET, natural Lampang kaolin and natural Ranong kaolin have a surface area of 16.02 m^2/g and 17.65 m^2/g, respectively. And the synthesis zeolite of Lampang kaolin and Ranong kaolin have a BET surface area of 27.654 m^2/g and 28.098 m^2/g, respectively. The conditions during all the experiments were initial concentrations of 0.5, 1, 2, 5, 10, and 50 ppm of pH 7. This experiment showed that most of the calcium concentration was adsorbed by both of the synthetic zeolites, which effectively adsorbs calcium. Therefore, it can be noted that synthetic zeolite might be one of many ways for natural groundwater treatment.

Keywords: Absorption, Kaolin, Metakaolin, Calcination

Role of trace elements affecting to different coloration on synthetic corundum

Arissara Aramrueng*
Kasetsart University, Bangkok, Thailand arissara.a@ku.th

Natthapong Monarumit Kasetsart University, Bangkok, Thailand fscinom@ku.ac.th

In general, the theory about the cause of color in corundum was related to trace elements to produce various colors. For example, Cr, Fe, and Ti play an important role in ruby and blue sapphire coloration. However, the cause of the coloration is still unable to clearly explain because the information from some sources is still conflicting and still controversial arguments. In this study, eight Verneuil synthetic corundum samples were selected with various colors including red, blue, dark orange, orange, green, violet, yellow, and colorless. The purpose of this study is to analyze the types and oxidation states of trace elements to explain the color mechanism of synthetic corundum. The samples were analyzed by Colorimeter, EDXRF, FTIR, UV-Vis-NIR Spectrophotometer, and X-ray Absorption Spectroscopy. As the result, the Cr^{3+}, Fe^{3+}, and Ti^{4+} were found in synthetic corundum samples which play an important role in causing colors. The energy band model of each color could be proposed for describing the role of trace elements affecting the different colorations on synthetic corundum.

Keyword: Verneuil, Energy Band, X-ray Absorption Spectroscopy (XAS)

Characteristic study of geopolymer concrete from recycle concrete aggregate, bagasse ash and latex sludge

Chayanit Deeklom*
Kasetsart University, Bangkok, Thailand chayanit.de@ku.th

Sarinya Paisarnsombat
Kasetsart University, Bangkok, Thailand fscisnpa@ku.ac.th

The most important materials in construction industry is concrete and cement. A production of cement releases large amount of carbon dioxide into the atmosphere. Nowaway, concrete has been demolishes and left as waste, which can be recycled in concrete production. This research studies characteristic of geopolymers from recycled concrete, with bagasse ash (BA) and latex sludge (LS) to improve the quality of concrete. Sodium silicate solutions (Na_2SiO_3) and sodium hydroxide (NaOH) solutions, with a concentration of 12 M and a ratio of 1:2.5, were used as an activator in decomposition of bagasse ash and latex sludge, with becomes binder material for geopolymers. The bagasse ash and latex sludge with a total of 10% and 20% by weight were used in geopolymer comcrete. Ratio of bagasse ash to latex sludge is 3:1, 2:1, and 1:1. The curing time of concrete are 3, 7, 14, and 21 days. The results show that 20% BALS with a ratio of 2:1 at 14 days curing gives the lowest compressive strength of 17.87 kg/cm^2. While, the 10% BALS with a ratio of 1:1 at 21 days curing gives maximum compressive strength of 119.86 kg/cm ^{2}. The gives highest density of 10% BALS (ratio of 3:1) at 7 days curing 2.11 k/cm^3. While, the 20% BALS (ratio of 2:1) at 14 days curing gives minimum density of 1.60 k/cm^3. Microstructure are also investigated under a scanning electron microscope. In conclusion, factors effect strength of the geopolymer from recycled concrete aggregate and BA-LS are amount of BA-LS addition, ratio of BA-LS, and size of recycled concrete aggregates.

Keywords: Geopolymer concrete, Concrete recycle, Bagasse ash, Latex sludge

Petrography and mineralogy of blueschist at Uttaradit Province

Chanakorn Janluechai*
Kasetsart University, Bangkok, Thailand chanakorn.j@ku.th

Prayath Nantasin Kasetsart University fscipyn@ku.ac.th

The occurrence of blueschist is a crucial existing of Nan-Uttaradit suture which is a main tectonic unit in SE Asia. The Nan-Uttaradit suture has originally designated to represent an amalgamation boundary between two Permo-Triassic volcanic arcs, Loei fold belt to the east and Sukhothai fold belt to the west. The objective of this research is to determine the mineral assemblages in blueschist and other rocks expose in the study area and map the distribution of blueschist outcrops and related lithologies in the pattern of strip geologic map. The rocks from the study area were prepared into petrographic thin sections and examined under petrological microscope to identify mineral assemblage and textures in the rocks. The results show the study area consist of three type of rocks including igneous rock, metamorphic rocks and sedimentary rocks. Under petrological microscope, the mineral assemblage of blueschist consists of barroisite + glaucophane + chlorite + epidote + quartz ± albite ± graphite ± stilpnomelane. The mineral assemblage of greenschist consists of chlorite + epidote + amphibole ± actinolite ± albite. The structure from fieldwork and petrographic thin section shows three main deformation events including S1-schitosity, S2-main fold and S3-crenulation. From the results, the area represents the affinity of accretionary wedge between Loei fold belt and Sukhothai fold belt. Existing of glaucophane affirms the subduction setting during the metamorphism event of this blueschist/greenschist.

Keyword: blueschist, greenschist, northern Thailand, Nan-Uttaradit suture

The influence of water level on the quantity of bloody cockle farming in Samut Songkhram Province

Thunyarat Piriyawiboonkul*
Kasetsart University, Bangkok, Thailand, thunyarat.pi@ku.th

Panu Trivej
Kasetsart University, Bangkok, Thailand, fscipntr@ku.ac.th

Pongsakorn Jiwapornkupt
Kasetsart University, Bangkok, Thailand, fscipsw@ku.ac.th

Bloody cockle farming is located in the coastal area that is about 2 km away from the shoreline with a substratum of fine and soft mud. The water depth in the farming area is about 0.5 - 1 m. This research aims to study the influence of water level on the quantity of bloody cockle farming in Samut Songkhram Province because Samut Songkhram Province is an important source of bloody cockle production in Thailand. It also receives a large amount of freshwater from the Mae Klong River. The results show that the water level has a statistically significant influence on bloody cockle farming yield ($r^2 = 0.392$, $p < 0.05$). In 2016, the average water level was 301.47 cm with a yield of 1,100.95 tons, while in 2007, the average water level is 288.95 cm with a yield of 9,147.5 tons. There was an increase in the water level of the Mae Klong River. As a result, bloody cockle farming yield in Samut Songkhram Province decreased. Although the results show certain link between water level and yield, further examination with the other factors may be needed to confirm the result.

Keywords: Anadara granosa, Mae Klong River, Cockle, Brackish water

Characteristics of spinels from Tajikistan and Vietnam

Yuparat Kwangsawat*
Kasetsart University, Bangkok, Thailand yuparat.kw@ku.ac.th

Somruedee Sakkaravej
Kasetsart University, Bangkok, Thailand fscisrd@ku.ac.th

Geological origin of gemstones can be increase their values. Pink spinels from Tajikistan and red, pink, and purple spinels from Vietnam were selected to study the physical characteristics, optical properties using basic gemological equipment. Mineral inclusions were identified by Laser Raman Spectroscope. Spinel samples from Tajikistan contained magnesite and rutile crystal inclusions. Apatite, calcite, dolomite and zircon inclusions were founded in Vietnamese spinels. Pink and red spinels from both localities show the absorption peaks of Cr^{3+} at 390 and 543 nm. The purple spinels from Vietnam showed the absorption peak of Fe^{2+} at 370 nm and Cr^{3+} peaks at 390 and 543 nm. Spinels from Tajikistan contain higher Fe_2O_3 than Vietnamese spinels. V_2O_5 content from Vietnamese spinels are higher than the samples from Tajikistan. Therefore, mineral inclusions and chemical composition can be determined the sources of spinel deposit.

Keywords : Mineral inclusions, Crystal inclusions

Hardness Removal in Groundwater by Clay-Based-Ceramic Adsorbents

Sasima Pongrak*
Kasetsart University, Bangkok, Thailand sasima.po@ku.th

Kannaree Chuangcham Kasetsart University fsciknr@ku.ac.th

Sasithorn Khonthon Rajabhat University sasithorn@pnru.ac.th

The high calcium of groundwater results in hard groundwater and causes many problems in the household, and filtration for water treatment is expensive. This study aims to study clay's physical and chemical properties and evaluate the removal efficiency for hardness removal in groundwater by clay-based ceramics. The local clay is generally available and low-cost material, including Ranong kaolin (N1), Lampang kaolin (N2), and bentonite (N3). All three types of clay are molded into granules and calcined at 700°C to become clay-based ceramic from Ranong kaolin (H1), clay-based ceramic from Lampang kaolin (H2), and clay-based ceramic from bentonite (H3). All adsorption experiments were run in triplicate and at the controlled temperature of 25±0.5 °C with synthetic groundwater at pH 7. The efficiency of calcium removal was analyzed. This study's results expressed that the calcium adsorption isotherms of N1, N2 and H2 were fitted to the Langmuir equation. Meanwhile, the adsorption isotherms of the Freundlich equation were better fitted for H1, H3 and N3. Cation exchange capacity and clay content reflect calcium adsorption behavior. It can be concluded that the adsorption capacity toward hardness should be N3 > H2 > H1 > H3 > N1 > N2. Moreover, the experiment shows that natural clay has a more effective sorption capacity than clay-based ceramic.

Keywords: Adsorption, Calcination, Calcium, Granule, Kaolinite.

Cause of color on amethyst samples under an in-situ heating condition

Sirinapa Saengdech*
Kasetsart University, Bangkok, Thailand sirinapa.sae@ku.th

Natthapong Monarumit Kasetsart University, Bangkok, Thailand fscinom@ku.ac.th

Amethyst is a variety of quartz (SiO_2) showing purple color. The color of amethyst is related to iron (Fe). The purple color of amethyst could turn yellow and colorless after heating at various temperatures. It was previously suggested that the color of amethyst can change due to the change in the Fe oxidation state. However, the cause of the color of amethyst before and after heating related to the Fe oxidation state was still inconclusive. This study aims to identify the Fe oxidation state of amethyst before and after heating and create an energy band model to explain the cause of color in amethyst samples under *In-situ* heating conditions at different temperatures. The spectroscopic techniques used in this study are Energy Dispersive X-Ray Fluorescence Spectrometer, Fourier Transform Infrared Spectrometer, UV-Vis-NIR Spectrophotometer and X-ray Absorption Spectroscopy focused on Fe *K*-edge XANES spectra. As the result, the color of the amethyst has turned yellow and colorless after *In-situ* heating at 500 °C and 700 °C, respectively. There was a change in the FTIR spectra and UV-Vis-NIR absorption spectra show different peak positions relating to the different energy band gaps. However, Fe *K*-edge XANES spectra on amethyst samples both before and after heating show Fe^{3+}oxidation state. Moreover, the samples show different energy band gaps derived from the Tauc Plot method before and after *In-situ* heating conditions. Therefore, the cause of color on amethyst can be explained by Energy Band Theory with the Fe^{3+}donor states.

Keywords: Fe oxidation state, X-ray Absorption Spectroscopy, Energy Band Theory

Characterization of Lateritic Soils as Pavement Material: Case Study in Khon Kaen Provinces

Konitah Tuanputeh*
Kasetsart University, Bangkok, Thailand konitah.t@ku.th

Kannaree Chuangcham Kasetsart University fsciknr@ku.ac.th

This study aims to test the engineering properties of lateritic soils on high and low terraces. The tests on the soil samples include the Atterberg limit test, grain size distribution, specific gravity, compaction test, and California Bearing Ratio (CBR) test. The study results show that high terrace soils have liquid limits of 22.83%, plasticity index of 7.90%, maximum dry density (MDD) of 2.25 g/cm³, optimum moisture content (OMC) of 8.65%, and CBR unsoaked 17.9% and Soaked 14.78%. Low terrace soil has liquid limits of 36.29%, a plasticity index of 13.25%, and a maximum dry density (MDD) of 2.18. g/cm³, optimum moisture content (OMC) 18.68%, C.B.R. unsoaked 8.59%, soaked 5.70%. Both laterite soils are classified as SC (clayey sand) according to the USCS, and gravel and sandy soils with good mix size according to the AASHTO classification. Compared with the Department of Public Works and Town & Country Planning, both lateritic soils did not pass the road work standard and specifications for subbase and base. However, they pass the road work standard and specifications for embankment or subgrade**.**

Keywords: Engineering properties, Compaction, California bearing ratio, Subbase, Base, Subgrade

Characterization of young mare basalt using crater counting

Natakorn Vijaranayarn*
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand natakorn.v@ku.th

Sarinya Paisarnsombat
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand fscisnpa@ku.ac.th

Crater counting is a technique used to measure the age of planetary surfaces by counting the number of craters on the surface. This technique has been used to characterize young mare basalt by calculating the Crater-Size Frequency Distribution (CSFD) and an estimate age of the surface, using equation from Neukum (2001). The equation has been used with the crater size of 1 kilometer in diameter and over. In this study, the equation was used with 500 m diameter crater to determine the feasibility of the calculations in areas with less large impact craters, such as young mare on the Moon. The landing site of (1) Apollo 11 located in Mare Tranquillitatis, (2) Apollo 12 located in Oceanus Procellarum and (3) Apollo 17 located in Mare Serenitatis were chosen to be study sites. By using data from Lunar Reconnaissance Orbiter (LRO) Wide Angle Camera (WAC : Resolution 100 m/pixel) and Narrow Angle Camera (NAC : Resolution 0.5 m/pixel) in the calculation give the ages of the study area are 3.6 ± 0.04 Ga, 3.5 ± 0.07 Ga and 3.6 ± 0.05 Ga, respectively. The age of the three study sites are similar to actual age of the apollo samples. This study will allow crater counting in young mare regions due to the relatively small number of craters and small size in these regions. The methods can be applied to other young age surface on other planets.

Keywords : Oceanus Procellarum, Mare Serenitatis, Mare Tranquillitatis, Absolute model ages

Shallow marine seismic reflection survey of the west coast, Phuket Province, Thailand

Daungjira Malthong*
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand daungjira.m@ku.th

Passakorn Pananont
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand fscipkp@ku.ac.th

Phuket is located in the southern region of Thailand and situates between the Ranong fault and the Khlong Marui fault. This study aims to investigate the structural geology under the shallow marine in the study area using shallow seismic reflection surveys. There are two survey lines that are paralleled to each other, oriented in the NW-SE direction, total length of 160 km. The processing steps consist of AGC, band-pass filtering, deconvolution, velocity analysis, NMO, and stacking. Analysis of the processed seismic data reveals the presence of stratigraphic layers and paleochannels in the study area. The depth of the paleochannel varies from 10-20 m with a width at 400-700 m. The depth of the sea floor varies from 30 to 90 meters. And a continuation of the fault in the first survey line with a depth of 10-20 m from the sea floor. The paleochannels can be used in economics for the construction of settlements or roads.

Keyword: shallow marine seismic reflection, seismic data processing survey, Phuket, marine geology

Impact of land use on precipitation in Nakhon Ratchasima Province

Toolnaphat soonthonsaratool*
Kasetsart University, Bangkok, Thailand , toolnaphat.s@ku.th

Dr. Panu Trivej
Kasetsart University, Bangkok, Thailand, fscipntr@ku.ac.th

The land use of Nakhon Ratchasima is mainly agricultural, accounting for 70.25 percent and the forest area accounts for 17.60 percent. The community and building area is 6.43 percent respectively. The research aims to study area which is located in Nakhon Ratchashima Province. Because Nakhon Ratchasima Province is frequently affected by rainfall. Farmers lack water for agriculture. This case to studying the relationship between land use properties and precipitation in Nakhon Ratchasima Province over the past 30 years. The result was found from in year 2000 to 2019 that the area of forest decrease 1.49 percent while the area of the urban land increase 120.92 percent and the area of agricultural decrease 14.91 percent respectively. Chok Chai rain gauge Station has the lowest average rainfall in the past 30 years at 92.043 millimeters per year while Prachinburi rain gauge station has the highest average rain fall in the past 30 years at 151.533 millimeters per years. The center of Nakhon Ratchasima Province has more drought than vicinage area. Because Nakhon Ratchasima Province has Phetchabun mountain range and Dong Phaya Yen mountain range in the west. In the south, there are the San Kamphaeng and Phanom Dong Rak mountain ranges.This is a barrier to prevent the southwest monsoon from blowing easily, causing rain on the western and southern sides of the mountains mostly.

Keywords: Rainfall, Agricutural, Urban land, Drought

Engineering Properties of Rocks for Construction Material in Phetchabun Province

Thanachanok Suksamran*
Kasetsart University, Bangkok, Thailand thanachanok.s@ku.th

Kannaree Chuangcham Kasetsart University fsciknr@ku.ac.th

This study aims to determine the suitability of rocks' engineering properties for construction materials widely used in engineering works. The crushed limestone was taken from Wichian Buri district (mill A), Chon Daen district (mill B), and Mueang Phetchabun (mill C) district, Phetchabun province with four sizes, including #2, #3/4, #3/8 inch. And crushed stone. Moreover, the various mechanical properties were investigated following road work standards, material testing standards, and ballast standards. These test results indicate that Mill A did not meet the standard for various crushed stone sizes. Mill B met only the asphalt concrete for crushed stone sizes #2, #3/4 and #3/8 inches. And Mill C, crushed stone sizes #2, #3/4 and #3/8 meet the soil and structural engineering standards, and crushed stone sizes #2 and #3/4 meet the asphalt concrete standard. Therefore, crushed stone from Mill C in Mueang Phetchabun District was the most suitable for extensive use. In addition, this study raises awareness of selecting construction materials for the safety of life and property.

Keywords: Limestone, Construction Material, Standard, Rock Mechanics.

Lithofacies of Permian System at Salaeng Phan tree tunnel, Saraburi Province, Thailand

Tidawan Prisana*
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand Tidawan.p@ku.th

Wasinee Aswasereelert
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand fsciwsn@ku.ac.th

Salaeng Phan tree tunnel located at National Highway No. 2089 from Muak Lek District towards Wang Muang District has no detailed of lithofacies. This area is composed of shale interbedded with limestone which belongs to the Nong Pong Formation. This study focuses on the classification of carbonate rocks of the Permian System at Salaeng Phan tree tunnel. They consist of biomicrite and micrite. This study can be used as a database for geological tourism at Salaeng Phan tree tunnel.

Keywords: Petrographic analysis, Nong pong Formation, Saraburi Group

A study of apatite in lunar meteorite

Preeyachat Yommana*
Kasetsart University, Bangkok, Thailand preeyachat.y@ku.th

Sarinya Paisornsombat
Kasetsart University, Bangkok, Thailand fscisnpa@ku.ac.th

Space exploration is a study that explain the universe or various phenomena that is outside of the Earth's atmosphere. The exploration has been started from the nearest object to Earth, the Moon. It is the first place where people are interested to explore. There is a tendency for more exploration of the Moon as well as being a starting point for setting up an exploration base on the Moon. By means of living on the Moon, it requires a lunar agriculture for food security on the Moon. Soil nutrients are one of the most important factor. One of the important nutrients for plants is phosphorus. It comes from calcium phosphate ($Ca_2(PO_4)_2$), such as apatite ($Ca_5(PO_4)_3(F,\underline{Cl},OH)$), through weathering process. This research aims to study an apatite content and a distribution of phosphorus in lunar meteorite samples; NWA 11273 and NWA 11474, which are lunar feldspathic breccia. The meteorite samples consist of diopside, olivine, anorthite, enstatite and troilite. Apatite was not found in the sample. However, phosphorus content is present in the matrix of NWA 11273 sample, approximately 2.43%, whereas no apatite nor distribution of phosphorous was discovered in NWA 11474. Aluminum, calcium, oxygen, magnesium and silicon were found throughout the NWA 11273 and NWA 11474 samples. The results suggest that phosphorus can be found on the Moon. However, it may not be an alternative source of phosphorus for Earth’s utilization. The future study of the meteorite and lunar samples would help shed a light on potential use of phosphorus in regolith for agriculture on the Moon as in-situ resource utilization (ISRU).

Keywords: Phosphorus, Lunar feldspathic breccia, Regolith, Natural resource, ISRU

A Study of Surface Morphology on Pink, Orange and White Freshwater Cultured Pearls

Pissanunya Anarat
Department of Earth Sciences, Faculty of Science, Kasetsart University, Bangkok, Thailand
pissanunya.a@ku.th

Somruedee Sakkaravej
Department of Earth Sciences, Faculty of Science, Kasetsart University, Bangkok, Thailand
fscisrd@ku.ac.th

Pearl luster is one of the huge factors in pearl's market which caused by the quality of pearls' surface. The aragonite is forming and arranging with the protein called conchiolin in brick-and-mortar structure. Another important factor of pearls grading is the color of pearls. These both factors are the important motive in this study. This study is determined to discover the relationship between both the pearl luster on the surface of pearls where the aragonite is arranging on and the color of pearls. The pearl samples were grouped by three different colors. Surface quality observed under Scanning Electron Microscope (SEM). The arranging of aragonite platelets on the surface of pearls with a good quality can obviously see a hexagon shape around 3 μm in diameter and the size of aragonite platelets on the surface of pearls are all equal which connected with other platelets. Pearls with medium quality luster have the size of aragonite from 2-4 μm which all platelets are not in the same size and shape. The aragonite platelets in medium quality pearls are slightly connected with other platelets and some platelets are not in a hexagonal shape, but the arrangement is still being organized. Meanwhile the poor luster orange pearl samples showed the unshaped aragonite platelets, which are around 1-5 μm. The arrangement of aragonite platelets are unorganized and not connected to another platelets.

Keyword: pearl luster, aragonite, pearls' surface

A sauropod dinosaur from the Jurassic of Chiang Muan District, Phayao Province, Northern Thailand

Wachirawit Kosulawath*
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand Wachirawit.kos@ku.th

Chatchalerm Ketwetsuriya
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand Fscisek@ku.ac.th

A sauropod dinosaur fossil from the early Jurassic (?Toarcian) has been discovered in Chiang Muan District, Phayao province. The specimens are preserved at the Sirindhorn Museum and have not been studied until today. We selected 27 specimens in good condition out of 104, including cervical vertebrae, dorsal vertebrae, and caudal vertebrae, for this study, which aims to describe the morphology and phylogeny of the sauropod from Chiang Muan. The results reveal that the sauropod has shared characteristics of Sauropoda and Eusauropoda, such as a cervical opisthocoelous shape, with the neural spine width exceeding length. Two new characteristics, a large spinodiapophyseal fossa and accessory lamina inside the spinodiapophyseal fossa, were found. The vertebrae of this sauropod are similar to those of *Tazoudasaurus*, *Shunosaurus* (e.g., has a hyposphene y shape and deep pleurocoel) and Eusauropoda in Laurasia and Gondwana from the early Jurassic. Morphological comparison with other sauropods shows the preliminary taxonomic position of the sauropod in the clade of Eusauropoda and may be related to *Tazoudasaurus* and *Shunosaurus*. This research reveals that the sauropod from Chiang Muan indicates the evolution of sauropods in Thailand between *Isanosaurus* and *Phuwiengosaurus*. This sauropod has a higher level of evolution than *Isanosaurus*.

Keyword: Sauropoda, Eusauropoda, Early Jurassic, Fossil, Taxonomy, Vertebrae

Properties of Local Clay Soil for Traditional Ceramics Usage in Wat Sing District Chai Nat Province

Waranya Thongngamkham*
Kasetsart University, Bangkok, Thailand waranya.thon@ku.th

Kannaree Chuangcham Kasetsart University fsciknr@ku.ac.th

Sasithorn Khonthon Rajabhat University sasithorn@pnru.ac.th

This study aimed to study the properties of local clay soil at Pak Khlong Makham Thao, Wat Sing district, Chainat province, in terms of ceramics. These physical and chemical properties were analyzed, including soil color, water content, grain size analysis, Atterberg's limits, refractoriness, linear shrinkage, water absorption, and mineral composition. The study results illustrate that the essential mineral of local clay soil comprised quartz and kaolinite. Moreover, the percentage of silica, alumina, and iron oxide is the highest. Before and after firing, clay colors expressed light brown to brown color and light orange, orange, and brownish orange color, respectively. The refractoriness of local clay soil is up to 1,200 °C without deformation. The linear shrinkage after firing was 8.11 to 13.12 percent, and the ability of water absorption was 6.85 to 13.18 percent. These findings indicate that the local clay soil at Pak Khlong Makham Thao is classified as earthenware ceramic suitable for manufacturing flowerpots, clay pots, bricks, clay roofing tiles, water jars, etc.

Keywords: Earthenware, Floodplain, Soil mechanics, Kaolinite

Developing Technique of Deep Resistivity Measurement to Study Mae Lao Hot Spring Resources, Chiang Rai Province

Warissara Sodarat*
Kasetsart University, Bangkok, Thailand warissara.sod@ku.th

Desell Suanburi Kasetsart University fscidss@ku.ac.th

Pongsakorn Jiwapornkupt Kasetsart University fscipsw@ku.ac.th

Hot spring zones are generally found as high potential and higher temperature at the Northern area of Thailand. Hot springs occurrence found in Thailand is typically relative with fault (or active fault) zone and probably granite rock. Mae Lao hotspring resources is a new challenge area, located at Huai San Plub Pla village No.5, Pong Prae Sub-district, Mae Lao District, Chiang Rai Province where found Mae Lao fault zone (in NE-SW direction) and about oriented cross to Pha Yao fault zone (in N-S Direction). The objectives are to study subsurface geological feature and prospect the possibility of Mae Lao hot-spring resources with a new modified achievement by combination with deep 2D and multi-gradient resistivity techniques and finally exploration drilling to about 300 m depth. Two survey lines (H and I) were located in N-S direction at the middle part of study area with 1000 m length and electrode spacing of 10 m. Resistivity measurement were assigned in two configuration technique (in different purpose) i.e. 2D resistivity reading with Schlumberger array for detailed and deep to 150 m. and modify multi-gradient technique to deeper portion and fill more detail data by expanding the distance of current electrode (AB) to beyond survey line to about 3000 m for the target depth of about 300 m. The results indicate the location of fault zone or the contact zone in the study. Underneath massive sedimentary rocks were found at depth of approximately 80 m. With 1D data processing, drilling location were pointed at distance 525 m of Line H and 635 m of LINE I. It can be concluded that the integration of 2D and multi-gradient resistivity techniques can be successfully existing 300m deep of subsurface geology relation with hot spring occurrence.

Keywords: Mae Lao hot spring, deep 2D resistivity, multi-gradient technique, Mae Lao and Pha Yao fault zone.

Development of concrete from Thailand Lunar Simulants (TLS-1)

Sutatta Tayadhammadhat*
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand Sutatta.ta@ku.th

Sarinya Paisarnsombat
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand fscisnpa@ku.ac.th

Space activities have taken another step especially on the Moon, where human exploration base has been of interest to many space agencies. One of challenges for establishment of human base on other planets is how shelter and accommodation should be established. A potential solution is to invent construction materials from local resources. Thus, this research aims to develop lunar concrete using agricultural waste and Thailand Lunar Regolith Simulant (TLS-1). The study was divided into 3 phases: (1) to study an optimum formula for concrete formation, (2) to study effect of water in the formation and (3) to study a relationship between an amount of lunar regolith simulant and potato fibers, forming and curing for 5 days. The results show that the best formula was LC1.5-FrF30%-1W given a compressive strength of 0.65 MPa. According to the TIS 58-2533 standard, construction concrete must achieve a compressive strength of at least 3.45 MPa. Thus, the lunar concrete may not be suitable for general construction work. For space activities, it can be applied as a material that can be easily molded and used with 3D-printing machines to produce various equipment needed on the moon. However, it is necessary to adjust formula to improve the mechanical properties of the concrete in order to use it as construction materials as in-situ resource utilization.

Keywords: Lunar concrete, Lunar regolith, Potato starch, Potato fiber, Geopolymer

Adsorption of Arsenic in Groundwater Using Diatomite

Suwannarat Boonyoo*
Kasetsart University, Bangkok, Thailand suwannarat.b@ku.th

Kannaree Chuangcham Kasetsart University fsciknr@ku.ac.th

This research aims to study the sorption capacity of arsenic using natural diatomite and acid- modified diatomite. Diatomite was characterized by scanning electron microscopy (SEM), surface area analyzer (BET), X-ray diffraction (XRD), and X-ray fluorescence (XRF). The natural diatomite was refluxed with different concentrations of hydrochloric acid (2M and 6M) at 60- 70°C for 3 hours. The modified diatomite was tested for arsenic adsorption in the solution at pH 4 and 6. The obtained results indicate that the surface area of natural diatomite, diatomite with HCL 2M and 6M values of 49.81, 42.80 and 53.98 m2/g and pore size values of 9.60, 9.76, and 12.52 nm, respectively. The adsorption isotherm of the diatomite showed that adsorption isotherm was fitted to the Langmuir at pH 4, natural diatomite, diatomite with HCL 2M and 6M equation with qm value of 1.23, 1.42, and 1.07 mg/g, respectively, and at pH6, natural diatomite, diatomite with HCL 2M and 6M equation with qm value of 1.50, 2.59, and 2.64 mg/g, respectively. These findings indicate that the modified diatomite treated with HCL 6 M had a better adsorption capacity to remove arsenic than the natural diatomite and modified diatomite treated with HCL 2 M. Keywords: Adsorbent, Heavy metal, Adsorption Isotherm, Acid treatment

Dam Foundation Improvement Using Cement Grouting: A Case study in Huai Mae Takung Project, Nong Prue District, Kanchanaburi Province

Nonthiphat Klinkesorn*
Kasetsart University, Bangkok,Thailand nontiphat.k@ku.th

Kannaree Chuangcham Kasetsart University fsciknr@ku.ac.th

Kampanart Kwansirikul Royal Irrigation Department kwansirikul@gmail.com

This research aims to study the dam foundation improvement using cement grouting and to explore the engineering properties of rock in a case study of the Huai Mae Takung Project, Nong Prue District, Kanchanaburi Province. They study the pilot hole and the check hole by analyzing the permeability test (Lugeon test), core recovery, rock quality designation, hardness, state of weathering rock, and the mechanics' laboratory. The results of the pilot hole and the check hole found in sandstone, core recovery is very poor to very good rock. Rock quality designation is very poor to very good rock. Hardness is soft to medium hard rock, state of weathering rock is moderate to high weathered, permeability test before the dam foundation improvement is moderate to very high (11.29-187.99 Lugeon), and after the dam foundation improvement is low to medium (4.59-9.76 Lugeon). After the dam foundation improvement using cement grouting, the water seepage value of the rock decreased, so the rock's lower permeability value was 5 Lugeon, increasing the rock foundation's strength. The conclusion is that the dam foundation improvement using cement grouting would reduce water seepage through the foundation and have the ability to retain water efficiently and safely.

Keywords: Lugeon test, Core recovery, Rock quality designation, Permeability test

Petrography of fluorite in Phanomtuan mine, Kanchanaburi Province.

Patinya Kasempatcharakit*
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand patinya.kas@ku.th

Prayath Nantasin
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand fsipyn@ku.ac.th

Phanomtuan mine situates within a complex geological setting which bedrocks were cut by N-S trending faults. Basement rocks in the mine area are predominantly composed of augen gneiss intermittent with mica schist, quartzite and biotite gneiss which crop out as a core of Khao Insi mountain range on western side of the mine. Foliation of these high-grade metamorphic rocks dip to the west. While the eastern side of this fluorite mine are made up of lower grade metamorphic rocks for instance marble, fine-grained biotite gneiss, fine-grained sillimanite-biotite gneiss, calcsilicates, marble and quartzite. These rock units also gentle dip to the west. The high-grade rocks and other lower grade units contact each other by such N-S trending faults. Aplite dykes (fine-grained leucocratic granite) cut through some high-grade and low-grade metamorphic rocks in the N-S trend with steep dipping angle. According to core drilling, seven fluorite veins were found along the fault. Two of them that situate in the middle are approximately 10 meters thick while the rest in both sides are mainly 1-2 meters thick. As same as other country rocks, fluorite veins also reveal a strong deformation which caused most of fluorite veins were deformed to be either concave layer or high angular irregular blocks. Based on mineralogy and texture, fluorite ores of the study area could be categorized to be 3 units that are composed of different assemblage including 1) fluorite + quartz + mica + sericite + apatite + opaque minerals, 2) fluorite + quartz + sericite + apatite + opaque minerals, 3) very coarse-grained, high-grade fluorite that does not contain other associated minerals. Fluorite crystals of unit 1 and 2 are mainly colorless while unit 3 display green, colorless and purple colors. Low-grade marble contains an assemblage calcite + mica + tremolite. Metasandstone also shows an alteration assemblage of quartz + chlorite + epidote + sericite. Based on field relationship, geological structures and textures, the hydrothermal veins are concordant to fault zone in the area, however, the sequence of these two events are still ambiguous and further study is required. In addition, strong deformation of fluorite veins might suggest that the fault in this mine is still active after the main mineralization stage.

Keywords: Fluorite, Petrography, Phanomtuan mine, Kanchanaburi

Oxidation state of iron (Fe) in spinel of calcsilicates pocket enclosed within marble at Skallevikhalsen, East Antarctica

Fuengnapa Phomjit*
Kasetsart Univeersity, Bangkok, Thailand, fuengnapa.p@ku.th

Dr. Prayath Nantasin
Kasetsart Univeersity, Bangkok, Thailand, fsipyn@ku.ac.th

Dr. Natthapong Monarumit
Kasetsart Univeersity, Bangkok, Thailand, fscinom@ku.th

Dr. Chatree Saiyasombat
Synchrotron Light Research Institute (Public Organization), Nakhon Ratchasima, Thailand, chatree@slri.or.th

This study focus on the oxidation state of iron (Fe) in spinel which coexists with corundum, calcite, diopside, phlogopite, apatite and graphite in calc silicate pocket that occur as lens-shaped enclosed within marble that has been metamorphosed under the conditions of high pressure and ultra-high temperature (UHT) at Skallevikhalsen, East Antarctica. Spinel crystals studied in this work are in-situ grains within natural specimens. They were analyzed by X-ray fluorescence (XRF) technique for qualitative determination of elements in spinel. Two groups of spinel were found in these samples including, spinel zinc ferrite that consists zinc and iron and hercynite spinel (FeAl2O4) that is mainly composed of iron. Subsequently, samples were analyzed by X-ray absorption spectroscopy (XAS), it was found that the oxidation state of iron in spinel was mainly Fe^{2+} with trace amount of Fe^{3+} which Fe^{2+} represented the blue spinel and the charge transfer between Fe^{2+} and Fe^{3+} produces a green, red-purple spinel. All analytical points were reaffirmed by Raman spectroscopy and most of them show the major peaks at 311, 410, 672, 770 cm^{-1}.

Keywords: X-ray fluorescence (XRF), X-ray absorption spectroscopy (XAS), Raman spectroscopy, Spinel, Antarctica

Differentiation of Trap prospects influencing the petroleum potential via PSTM 3D Seismic data in Maari Field, Taranaki Basin, New Zealand

Makorn Sriwiset*
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand makorn.s@ku.th

Chatchalerm Ketwetsuriya
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand fsciek@ku.th

Sopon Pongwapee
sopon_geo@hotmail.com

The petroleum potential in Maari Field, Taranaki Basin of New Zealand is distinctly distributed. The field was opened in Cretaceous relating with Australian – New Zealand seafloor spreading. Next, post-rift was occupied by compressional stress due to Australian – Pacific plate subduction convergent in late Miocene, and tensional stress dominated in the field later by releasing pressure in Pliocene. Significantly, Trap which is as important as reservoir is a primary key to indicate prospective closure in Petroleum business. 3D PSTM seismic reflector is interpreted in multiple layers to describe the trap into six styles: (1) Inversion anticlinal trap in syn-rift, (2) Channel stratigraphic trap in syn-rift, (3) Fault propagation fold trap in post-rift, (4) Compressional anticline trap in post-rift, (5) Footwall trap in post-rift, and (6) Angular unconformity trap in post-rift. The study then exhibits the great trap potential in the field as anticlinal trap both in syn-rift (1), (3) and (4) by ranking with key controlled factors of timing between migration and closure, size of prospect, seal potential and migration pathway.

Keywords: New Zealand, 3D Seismic interpretation, Structural evolution, Trap classification

Cave mapping and Thermoluminescence dating at Daowadueng Cave, Sai Yok District, Kanchanaburi Province

Wanichaya Wannaprasert*
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand wanichaya.w@ku.th

Krit Won-in
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand fscikrit@ku.ac.th

Daowadueng Cave is a limestone cave. The speleothem found inside Daowadueng Cave includes stalagmites, stalactites, draperies. Considered one of the famous and beautiful caves in Thailand. Daowadueng Cave is in the national park area Sai Yok, Sai Yok District, Kanchanaburi Province. This research project has studied the Thermoluminescence dating of some sediment in the cave and mapping the paths within the cave by measuring distance and directions with a laser rangefinder. The objective is to determine the age of sediment within Daowadueng Cave and create a plan that shows the walking route within Daowadueng Cave. According to this survey, the sediment that determines the age by the heat fluorescence method is aged in the range of 17,836-40,500 years ago. The preparation of the map that shows the walking path inside the cave Daowadueng Cave is about 60.814 meters long, and found speleothem inside the cave includes stalagmites, stalactites, flowstones, columnar pillars, draperies, and bacon formation. This study shows that the method of determining age by Thermoluminescence dating and mapping the path inside the cave by measuring the distance and direction with a laser rangefinder to apply to other caves. And people who are interested in studying about Daowadueng Cave can use the information obtained from this research to use in geology and geological tourism.

Keyword: Thermoluminescence dating (TL), Stalagmites, Stalactites, Flowstones, Columnar pillars, Draperies

Spectroscopic study on ruby samples from Mong Hsu, Myanmar before and after irradiation by high-energy electron

Sayon chuaychoo*
Kasetsart University, Bangkok, Thailand sayon.c@ku.th

Natthapong Monarumit Kasetsart University fscinom@ku.ac.th

Ruby is a variety of corundum (Al_2O_3) showing red color. Mong Hsu, Myanmar is one of the important sources of ruby with specific characteristics especially the presence of a dark or blue core at the center of the ruby sample. The red color of ruby is caused by impurities of chromium (Cr) as well as the blue color of the dark core is caused by the Fe-Ti pair. Nowadays, heat treatment and irradiation have been applied to enhance the ruby samples in gem markets. The purpose of this study is to analyze and create an energy band model to explain the cause of color in ruby samples from Mong Hsu, Myanmar before and after irradiation by the high-energy electron beam. The eight ruby samples were divided into two sets including either non-irradiation or irradiation by the high-energy electron beam. Each set includes unheated; and heated at 800 °C, 1200 °C, and 1650 °C Then, the samples were analyzed with advanced gem instruments such as UV-Vis-NIR, X-ray Absorption Spectroscopy, Fourier Transform Infrared Spectrometer, and Energy Dispersive X-ray Fluorescence Spectrometer. As the result, the irradiated sample shows that the intensity of the blue core in the sample was decreased whether or not undergone heating experiments. The red part of the samples was unchanged after irradiation. The Tauc Plot of the samples shows a tiny different energy band gap before and after irradiation as well as heating experiments. It can be concluded that irradiation could be a method for eliminating the blue core of the ruby samples like the heat treatment at high-temperature conditions.

Keywords: Corundum, Energy band theory, X-ray Absorption Spectroscopy

Assessment of Rare Earth potential in fluorite tailing in Phanomtuan mine, Huai krachao District, Kanchanaburi Province

Natchaphat Phukhang*
Kasetsart University, Bangkok, Thailand sukanda.p@ku.th

Prayath Nantasin Kasetsart University fscipyn@ku.ac.th

Theerayut Phengsaart Chulalongkorn Universitytheerayut.p@chula.ac.th

This study aimed to find the types and quantities of earth elements in the tailing of fluorite mine at Phanomtuan Mine, Huai Krachao District, Kanchanaburi Province. The tailings resulted from fluorite dressing plant is over 6,000 metric tons per month in this moment even though the mine has not fully exploited yet. Five concessions are hold by the same company with a reserve approximately 1 million tons. Therefore, a huge tailing will be produced throughout the life time of this mine. Our hypothesis is based on many current researches that mentioned a potential of rare earth element in fluorite mines around the world. Our preliminary result shows that the tailings at Phanomtuan Mine contain significant amount of heavy minerals. X-ray diffraction (XRD) was applied to analyze heavy mineral portion of seven samples and The results indicated the existing of quartz, fluorite, calcite, kaolinite, orthoclase, llilite, microcline and muscovite. X-ray fluorescence (XRF) was employed to quantify an amount of REEs in 12 samples. The XRF results show that heavy minerals contain some rare earth elements which are significantly high including Ce, Y, Yb, Lu, and Eu with an average of 45.62 ppm for Ce, 31 ppm for Y, 28.06 ppm for Yb, 2.36 ppm for Lu, and 154.62 ppm for Eu. According to our result, it seems that the tailing of Phanomtuan fluorite mine has a significant amount of rare earth bearing minerals and the further assessment in detail is required in order to precisely estimate its economic potential.

Keywords: Fluorite tailing, rare earth elements, Kanchanaburi, Thailand.

Compare the specific composition of particulate matter (PM) in urban areas and cement industry

Suratchana Banchom*
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand Suratchana.ba@ku.th

Pongsakorn Jiwapornkupt
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand Pongsakorn.w@ku.th

Asst. Prof. Dr.Natthapong Monarumit
Department of Earth Sciences, Faculty of Science,
Kasetsart University, Bangkok, Thailand Natthapong.mon@ku.th

The particulate matter has an impact on Thailand's ecology, health and numerous other issues. The composition of the particulate matter depends on the source. The purpose of this study is to analyze the chemical composition of particulate matter and predict the source of particulate matter. Collect particulate matter samples on Suwanvajokkasikit Road. Science Laboratory Building (SCL). Faculty of Science, Kasetsart University, in January and March. Use TSP High Volume Air Sampler for sampling. Analysis of the X-ray fluorescent (XRF) method revealed that the elements appearing on the filter paper are Zinc, Manganese and Iron, respectively. The particulate samples include Iron, Zinc, Copper, Manganese, Arsenic and Lead, respectively. The X-ray Absorption Spectroscopy (XAS) method analyzes samples against the standard compounds of each element to determine the compounds contained in particulate matter. Calibration curve between particulate matter sample and standard compound from the analysis results, the calibration curve for the standard compound has a good level of linear relationship with the dust sample. The following are available: Iron includes compounds of FeO(OH) and Fe_3O_4. Copper compounds include CuO compounds. Manganese compounds include $MnSO_4$-$2H_2O$ compounds. Arsenic compounds include As_2O_5 and As(V)+BN. Lead compounds include $PbCl_2$, $Pb(NO_3)_2$ and $PbCO_3$, and Zinc compounds $ZnCl_2$.

Prediction of the source of various elements of the analysis of compounds found in particulate matter, it was found that manganese can be used as a color mixture. Arsenic is used as a component of alloys. Iron, Copper and Lead are compounds in the production of paints, rubbers, batteries, construction materials, materials such as wires, alloys and materials for vehicles. Therefore, it is likely that the particulate matter present in the study area will originate from the construction in the vicinity. Vehicles roam the area. And zinc is present in filter paper because it is used as a fungal agent in filter paper.

Keywords: XAS, XRF, Heavy element, TSP

Influence of minerals in groundwater on coffee and cocoa flavors

Orakoch Pansila*
Kasetsart University, Bangkok, Thailand orakoch.p@ku.th

Kannaree Chuangcham Kasetsart University fsciknr@ku.ac.th

This research aims to study the number of groundwater minerals affecting coffee and cocoa flavors. This study used three types of water samples, i.e., bottled water, groundwater treated with reverse osmosis (RO), and mineral-adding in groundwater treated with reverse osmosis (RO). The chemical composition is determined by considering the drinking water quality standards and analyzing the number of cations and anions. Then the RO water adjusts the mineral content with an initial TDS value of 50-300 mg/L. To make drinks with different TDS values, the 50 panelists evaluated preferences for drink samples. The results of this study revealed that the panelists could recognize the difference in taste. The prominent sensory variability between samples was due to salinity. The saltiness had a solid linear positive correlation to the TDS, conductivity, and Na concentration (R^2 = 0.9996). For milk-based beverages, participants were satisfied with the taste of water with a TDS between 300 and 320 mg/L, which differs from coffee beverages with a TDS between 80 and 85 mg/L. The panelists were statistically significantly more satisfied. Adding minerals to groundwater is an essential factor in the perception of water taste, which can affect the flavor of beverages. This research can be applied in designing water formulations for brewing beverages and educating consumers about coffee entrepreneurs.

Keywords: Total Dissolved Solids, Reverse Osmosis, Beverage

Landscape and Thermoluminescence dating at Phra That Cave, Si Sawat District, Kanchanaburi Province

Napasorn Songjaroensub*
Kasetsart University, Bangkok, Thailand napasorn.son@ku.th

Krit Won-in Kasetsart University, Bangkok, Thailand fscikrit@ku.ac.th

Phra That Cave, Si Sawat District, Kanchanaburi Province, is a tourist area of geological, and there is a great abundance of cave resources. This research aimed to study landscape, cave mapping and Thermoluminescence dating of the travertine in the cave, which explored the route map inside the cave from a laser distance meter and a clinometer. According to the survey, Phra That Cave is a cave with a distance of 518 meters. The main cave hall is located the northwest to southeast direction, divided into 7 chambers, namely, Kob cham-sin chamber is 45.77 meters long. Thongfa cham-long chamber is 54.676 meters long, Ra-khang chamber is 17.872 meters long. Phra That chamber is 43.461 meters long, Sao-Ek chamber is 38.117 meters long, Coral chamber is 45.949 meters long, and Man Li-ke chamber is 34.578 meters long. The speleothems are found, such as stalagmites, stalactites, column, soda straw, flowstone, rimstone, bacon curtains etc. Which are characterized by translucent speleothems. Results of the study on determining the age of speleothems by Thermoluminescence dating came from two travertine samples found inside the Phra That Cave that were used to calculate the age by the additive dose method. The age range was 386782 ± 15007 years and 239267 ± 14547 years.

Keyword : Calcite, Cave mapping, Gamma ray spectrometer, Speleothems, Travertine

A Comparison of Three Statistics for Mean Difference Testing Between Two Independent Populations

Suwimon Arunuaong*, Verapat Sirichotikul, Kirana lnchan, Rasameedao Sutthisri,

Ampai Thongteeraparp
Department of Statistics, Faculty of Science, Kasetsart University, Bangkok 10900
Corresponding author. E-mail adder: suwimon.a@ku.th

The objective of this research is to compare the statistics for testing the mean difference between two independent populations. The three methods are Brunner-Munzel test, Mann-Whitney test and Yuen-welch test. The populations have continuous Uniform distribution and Lognormal distribution with equal and unequal sample sizes. The level of significance is 0.05 and simulated data for each simulation is 1000 times. The results show that the probability of type I error of all three test statistics can be controlled for almost all cases. Mann-Whitney test cannot control the probability of type I error in some sample sizes. Brunner-Munzel test has the highest power of the test. Mann-Whitney test and Yuen-welch test have the highest power of the test when the sample sizes and variances are not equal.

Keywords: Brunner-Munzel test, Mann-Whitney test, Yuen-welch test

Knowledge, Perceive stress, anxiety and Preventive Behaviors of COVID-19 outbreaks among student in Kasetsart University

Pichaporn Rattanaart*, Mayurachat Hantunphong, Phakawan Thoaran, Sarunporn Suttirak,

Sirinya Teeraananchai
Department of Statistics, Faculty of Science, Kasetsart University, Bangkok

The purpose of this research was to study knowledge, stress, anxiety, and prevention behaviors of the spread of COVID-19 in undergraduate students at Kasetsart University Bangkhen Campus. The research tool was a questionnaire, consisting of 5 parts: 1. General information, 2. Knowledge and understanding of COVID-19, 3. The Department of Mental Health's concern screening form for COVID-19, 4. Assessment form at stress level (ST5) by the Department of Mental Health and 5. preventing behaviors of COVID-19 outbreak. Descriptive statistics used were percentage, mean and standard deviation. Tobit Regression analysis wasused to assessthe association between factors and prevention behavior of Covid-19 epidemic. and studying factors affecting re-infection. Using Logistic Regression Analysis , the results revealed that factors affecting COVID-19 prevention behaviors were gender and stress levels. Factor associated with the re-infection of COVID-19 included the level of concern about COVID-19 with a statistical significance level of 0.05.

Keywords: Perceive, stress, anxiety, COVID-19

Evaluation of probiotic survivability and affected factor(s) in plant-based milk ice cream matrix.

Phatthirawan Jannoi*
Kasetsart University, Bangkok, Thailand phatthirawan.j@ku.th

Rachatida Det-udom Kasetsart University fscirid@ku.ac.th

Ice cream is a popular ready-to-eat dessert for people of all ages because of its refreshing character. However, the dairy-based ice cream is not suitable for lactose intolerance. The objective of this research was then to determine the formulation of prebiotic white bean milk ice cream supplemented with probiotic microorganisms. Viability and the affecting factors were also evaluated. Result indicated that the microbe could not survive in this plant-based product. Therefore further solution of Ca^{2+}-alginate spherification technique was then applied in order to prolonged probiotic viability. In this encapsulation approach, any juice and healthy drinks including honey tea could be selected.

Keywords : Probiotic, Prebiotic, Spherification, White bean milk, Ice cream

Study of *Russula emetica* Crude Extracts in An Inhibitory Effect on Human Papillomavirus Type 16-Infected Cervical Cancer Cell Line

Keeratikorn Promnikorn*
Kasetsart University, Bangkok, Thailand keeratikorn.p@ku.ac.th

Jureeporn Chuerduangphui Kasetsart University fscijoc@ku.ac.th

Russula emetica is a mildly poisonous mushroom that has a bitter taste and causes vomiting but it can be eaten by cooking in hot water. The extract of *R. emetica* increased the cytotoxicity of doxorubicin in different cancer cell lines. However, there is no report the effect of *R. emetica* extract in cervical cancer. This study aims to investigate the effect of *R. emetica* extract from fresh and dried fruiting body on human papillomavirus type 16 (HPV16)-positive cervical cancer cell lines CaSki and SiHa. The extracts were derived from boiled mushroom in hot water at 100°C. The cytotoxicity of the extracts was determined in CaSki, SiHa and 293FT using MTT. The result showed that the extract from dried fruiting body (146.22±0.028 mg/ml) had higher cytotoxicity in CaSki at 50% inhibitory concentration (IC50) than fresh (175.87±0.07 mg/ml). In contrast to CaSki, the extract derived from fresh (130.56±0.03 mg/ml) had higher cytotoxicity in SiHa than dried (170.96±0.01 mg/ml). In addition, the extracts from either boiled fresh or dried mushroom water that were dried by a freeze-drying and dissolved in dimethylsulfoxide had IC50 at 4.44±0.27 mg/ml and 9.43±1.15 mg/ml of fresh and dried fruiting body in treated CaSki, respectively. The extracts from boiled mushroom water were used to assess anti-growth of cervical cancer cells including cell proliferation, cell migration, colony formation and apoptosis using MTT, wound healing, colony-forming and dual staining with acridine orange/ethidium, respectively. From the result, both extracts inhibited cell proliferation, cell migration and colony formation in dose-dependent manner particular 100 mg/ml extracts and increased apoptotic cells in CaSki and SiHa. However, both extracts did not promote the caspase 3 activity. Expectedly, boiled mushroom water and freeze-dried extracts inhibited mRNA expression of HPV16E6, c-*fos* and *YY1* in treated CaSki measured using real-time quantitative PCR. The extracts from boiled mushroom water promoted p53 protein expression investigated by western blot. However, the extracts had no effect on anti-viral infection. These result demonstrated that *R. emetica* extracts particular fresh mushroom inhibited the growth of cervical cancer cells and decreased the mRNA expression of HPV16E6 and cancer-related genes, and increased tumor suppresser p53 protein expression.

Keywords: *Russula emetica*, human papillomavirus, cervical cancer.

Production of Mycelium-Based Tray from Agricultural Waste for Styrofoam Replacement

Chuthathip Chuchit*
Kasetsart University, Bangkok, Thailand Chuthathip.ch@ku.th

Chestsada Pothiratana Kasetsart University fscicsd@ku.ac.th

Styrofoam packaging is produced from petroleum production, which is widely used in the food industry. The most disregarded foam product is foam trays which is not biodegradable, causing environmental problems. At present, utilization of agricultural waste materials is environment-friendly option for production of mushroom mycelium-based tray for Styrofoam replacement. In this research, four studied mushroom species were *Lentinus polychrous* Lev., *Schizophyllum commune*, *Ganoderma lucidum* and *Pleurotus pulmonarius*. The mushroom millet seed inoculums were inoculated in four substrates namely coconut meal, rice husk, sawdust and bagasse to determine suitable agricultural waste materials for mycelium, growth and showing foam-like characteristic. Then, mushroom mycelia grown in various materials were cultivated in tray blocks to form tray-shaped materials. Finally, they were heat-dry into mycelium composites trays and test the mechanical properties. The results showed the highest mycelium growths in rice husk. Mycelium based tray made from *Lentinus polychrous* Lev. showed texture most similar to Styrofoam. Density of mycelium materials in this study were in the range of foam and natural materials. *L. polychrous* Lev. in rice husk showed the least absorb water while *Lentinus polychrous* Lev. in sawdust and bagasse showed modulus of rupture (MOR) equal to expanded polystyrene at the value of about 0.1 MPa. Therefore, the production of mycelium composite trays is potential way for Styrofoam replacement.

Keywords: Styrofoam, Agricultural waste, Fungal mycelium, Mycelium composites, Mechanical properties

Identification and probiotic properties of *Lactobacillus* sp. L46-12

Walaipun Rukprasert*, Worrapot Pengpa
Kasetsart University, Bangkok, Thailand walaipun.r@ku.th

Tanes Sangsri
Princess of Naradhiwas University, Naradhiwas, Thailand

Patcharaporn Siwayaprahm Kasetsart University fscippsp@ku.ac.th

Lactobacillus sp. L46-12 is a lactic acid bacteria isolated from the sewer pipe of the dairy factory, Kasetsart University. Morphological characterization, biochemical test and 16S rRNA gene sequencing analysis showed that *Lactobacillus* sp. L46-12 was 100% identical to *Lactobacillus plantarum*. The adhesion of *Lactobacillus* sp. L46-12 was observed using human colon adenocarcinoma (Caco-2 cell line), and *Lactobacillus casei* subsp. *rhamnosus* was used as the positive control strain. The result showed that the percentage of adhesion to the surface of Caco-2 cells by *Lactobacillus* sp. L46-12 was comparable to *Lb. casei* subsp. *rhamnosus*. The competition of adhesion between *Lactobacillus* sp. L46-12 and enteropathogenic bacteria (*Bacillus cereus* BCC386, *Escherichia coli* ATCC8739 and *Salmonella* Typhimurium DMST562) to Caco-2 cells by *in vitro* assay was assessed. It was revealed percent adhesion of *E. coli* ATCC8739 and *S.* Typhimurium DMST562 to Caco-2 cells was significantly lower when competed to *Lactobacillus* sp. L46-12. Also, the adhesion inhibition assay of enteropathogenic bacteria by *Lactobacillus* sp. L46-12 was determined, and the markedly reduction of *B. cereus* BCC386, *E. coli* ATCC8739 and *S.* Typhimurium DMST562 attachment was revealed. From our finding, *Lactobacillus* sp. L46-12 has preliminary features of being probiotics.

Keywords: Probiotic, *Lactobacillus,* Adhesion, Enteropathogenic bacteria.

Study of *Russula emetica* Crude Extracts in An Inhibitory Effect on Herpes Simplex Virus Type 1 and 2 in Vero Cell Line

Chanet Kritsanumphok*
Kasetsart University, Bangkok, Thailand Chanet.k@ku.th

Jureeporn Chuerduangphui Kasetsart University fscijoc@ku.ac.th

The sickener (*Russula emetica*) is a mushroom that is commonly found in wetland forests in Europe and Asia. *R. emetica* is a mildly poisonous mushroom and edible when cooked with sufficient heating so that its poison could be neutralized. There are some reports which suggest that the extracts from different types of mushrooms could inhibit herpes simplex virus type 1 and 2 (HSV-1 and HSV-2) but there is no existing report of *R. emetica* extract effectiveness in viral inhibition. This study aims to investigate the extracts from fresh and dried *R. emetic* fruiting body boiled in water at 100°C for 2 hours. The cytotoxicity of the extracts in Vero cells was measured using MTT assay. The sub-toxic concentrations were used to investigate anti-HSV-1 and HSV-2 in pre- and post-entry steps using plaque assay. From the result, the extracts of boiled mushroom water derived from fresh and dried fruiting body inhibited HSV-1 and HSV-2 in dose-dependent manner (0, 1, 5, 10, 15 and 30 mg/ml). In addition, boiled mushroom water dried using a freeze-dry system and then dissolved in dimethylsulfoxide inhibited HSV-1 and HSV-2 in dose-dependent manner (0.5, 1 and 2 mg/ml). The mRNA expression of viral UL30 and gD was suppressed in the freeze-dried extract-treated cells in contrast to control. Expectedly, the extracts suppressed viral gB protein expression and viral copy number. All of these results indicated that *R. emetic* extracts particular dried fruiting body higher effectively inhibited HSV-1 and HSV-2 than fresh mushroom through suppression of viral UL30, gD and gB expression.

Keywords: *Russula emetica*, Herpes simplex virus, Mushroom

Comparison on plant growth-promoting characteristics of plant growth promoting and inhibiting bacteria isolated from duckweed *Spirodela polyrhiza*

Buranaporn Buranathong*
Kasetsart University, Bangkok, Thailand buranaporn.b@ku.th

Chanita Boonmak Kasetsart University, Bangkok, Thailand fscictb@ku.ac.th

Duckweed is a small aquatic plant that floats on the water surface and grows rapidly in natural water. Previous studies have been highlighted potentials of duckweed in wastewater treatment and production of valuable biomass due to its high ability to accumulate starch and protein. In order to obtain duckweed with high growth rate and high biomass production, it's necessary to study the factors that promote the growth of duckweed, including duckweed associated bacteria. This study aimed to compare plant growth-promoting characteristics of plant growth-promoting bacteria (PGPB) and plant growth-inhibiting bacteria (PGIB) isolated from duckweed *Spirodela polyrhiza* from a previous study. A total number of 27 isolates comprised with PGPB 15 isolates, PGIB 10 isolates, and two new species candidates. The results revealed that all isolates of the duckweed associated bacteria were positive on siderophore production. Most of them could solubilize phosphate. However, only a few isolates showed positive on potassium solubilization. Assessment of indole-3-acetic acid (IAA) production in different tested media showed that all bacteria could produce IAA in both ½ TSB-based and Hoagland-based media. However, the amount of IAA production in different nutrient conditions was different. The study on utilization of nitrogen sources showed that all isolates were able to use organic nitrogen sources, however, most of them could not utilize inorganic nitrogen sources. Hence, they are suitable to use to promote plant growth due to lack of plant nutrient competition. Even though some duckweed associated bacteria were motile and some were non-motile, all isolates could produce biofilm to attach to the duckweed surface. Several tested bacteria were positive for amylase production. Only a few isolates were able to produce cellulase and protease. The results can be used as the preliminary criteria for the selection of bacteria to promote the duckweed growth under different cultivating conditions.

Keywords: *Spirodela polyrhiza*, Duckweed-associated bacteria, Plant growth-promoting characteristics, Nitrogen utilization, Plant nutrient competition.

The Study of Fungal Diversity and Effects On Rice Growth From Soils of Thale Noi, Phatthalung Province

Kanokorn Changto*
Kasetsart University, Bangkok, Thailand Kanokorn.ch@ku.th

Salisa Suchitwarasan Kasetsart University fscisssp@ku.ac.th

The purpose of this study was to study the total number and diversity of fungi from soil samples and *Sarkidiornis melanotos* excrement, Thale Noi, Phatthalung Province and their potential to promote the rice growth under greenhouse condition. Soil without bird inhabitants, soil with *Sarkidiornis melanotos* inhabitants, soil with various bird inhabitant and *Sarkidiornis melanotos* excrement were collected. The soil sample without bird habitation showed the highest number of fungi at $4x10^5$ CFU/g. The sampling of fungi with different characteristics was found to be able to isolate 16 isolates, 12 isolates, 2 isolates and 4 isolates respectively. Seedling by cultivating the rice plants with the samples by using rice variety Dawk Mali 105 and the RD15 variety was conducted. Root length, stem length and plant biomass were then measured. It was found that rice plants had an increase in germination rate, root length, stem length and plant biomass when treated with samples in which various birds were inhabited. The uncultivated rice plants were compared with the sample. The biomolecular analysis of root samples fed with soil samples of various bird species was analyzed by using ITS1 and ITS4 as primers and then analyzed by NGS (next generation sequencing). The roots of rice plants are mainly colonized by the fungi in phylum Ascomycota. Therefore, it can be concluded that cultivating rice plants with a soil that inhabited by various birds can promote the best growth of rice plants in this study.

Keywords: rice, soil fungi, Ascomycota

Study on factors promoting carotenoids in red yeasts

Kassarin Sanmuen*
Kasetsart University, Bangkok, Thailand kassarin.s@ku.th

Noppon Lertwattanasakul
Kasetsart University, Bangkok, Thailand fscinple@ku.ac.th

Carotenoids represent a group of valuable molecules for the pharmaceutical, chemical, food and feed industries, not only because they can act as vitamin A precursors, but also for their coloring and antioxidant activity. Several microorganisms, including bacteria, algae, molds and yeast are able to produce carotenoids naturally. The advantages of microbial fermentation of carotenoids are the fast growth rate and low media costs. The purposes of this research are to select yeast strains that produce high carotenoids and to study factors that promote carotenoid production. Thirty-two red yeasts previously isolated from solar saltern, Samut Songkhram Province, were investigated. Of 32 yeast strains, only 7 strains, T19R, T19M, D17R, D7M, C1M, NSL1-2 and T20M, were found to produce carotenoids. The strain T19R produced the highest carotenoids of 1.181 mg/L. Seven yeast strains were subsequently subjected to study the effect of metal ions on carotenoid production. Addition of both metal ions, $ZnSO_4$ and $FeSO_4 \cdot 7H_2O$ increased carotenoid production in all strains tested. The carotenoid production of the strain T19R was enhanced by 38.80% (3.10 mg/L) and 32.77% (2.61 mg/L) when $ZnSO_4$ and $FeSO_4 \cdot 7H_2O$ were added, respectively.

Keywords: red yeast, carotenoid, metal ion

Mass production of *Lentinus squarrosulus* mycelia by submerged cultivation with improved cosmeceutical activities

Chayanee Kaveech
Kasetsart University, Bangkok, Thailand.

Churapa Teerapatsakul
Kasetsart University, Bangkok, Thailand. fscicpt@ku.ac.th

Mushrooms are recognized as an important source of natural bioactive compounds that are increasingly utilized as cosmeceutical ingredients. Antioxidants, anti-collagenase, and anti-melanogenesis by tyrosinase inhibitors are very attractive as substances that can serve as protecting agents for skin aging and skin color. In the present study, mycelial submerged cultivation of *Lentinus squarrosulus* supplemented with napier grass juice and coffee grounds, and the cosmeceutical activities of the compounds present in this species were determined. The cosmeceutical potential of *L. squarrosulus* mycelia was investigated in terms of anti-tyrosinase, anti-collagenase, and antioxidant activities. Antioxidant activity was determined by the scavenging of DPPH assay. Crude extracts derived from the submerged culture mycelium extracted separately using cold water and hot water were prepared to compare the bioactivities. Mycelial biomass production of *L. squarrosulus* in submerged cultivation was improved by 0.5% coffee grounds and 2.5% napier grass juice. Additionally, both water extracts of the mushroom mycelia cultivated in 0.5% coffee grounds and 2.5% napier grass juice culture exhibited greater all the bioactivities tested. These findings suggest that the mycelial extract of *L. squarrosulus* in submerged cultivation supplemented with coffee grounds and napier grass juice could be further studied and developed as a natural ingredient for the cosmeceutical product.

Keyword: antioxidant, cosmeceutical activity, extract, *Lentinus squarrosulus*,mushroom

Expression of recombinant Lumpy skin disease virus P32 protein in *Escherichia coli*

Chayaporn Srijan
Department of Microbiology, Faculty of Science, Kasetsart University,
Bangkok, Thailand chayaporn.sr@ku.th

Jadsada Ratthanophart*
Pathology section, National Institute of Animal Health,
Bangkok, Thailand jrattha@gmail.com

Prissana Wiriyajitsomboon*
Department of Microbiology, Faculty of Science, Kasetsart University,
Bangkok, Thailand fscipnw@ku.ac.th
*: Corresponding author

The lumpy skin disease virus (LSDV) has had an economic impact on the livestock farming of the country over the past few years, causing losses to farmers regarding opportunities for international trade and increased productivity. Therefore, the diagnosis is important to help prevent the spread of the virus. However, the expression of recombinant P32 protein in prokaryotes has rarely been reported. Therefore, this study aimed to express recombinant p32 protein in *Escherichia coli* representing as the prokaryotic system. The P32 gene was amplified by PCR, yielding approximately 1000 bp of DNA, which was the expected size. The resulting DNA fragment was cloned into the pET-24a vector and transformed into *E. coli* BL21 by heat shock method. Then, the rP32 protein was purified using Ni-NTA resin and confirmed the molecular weight by SDS-PAGE and Western blot techniques. The results of Western blotting using anti-HRP antibody obtained from Lumpy skin diseased cows revealed an approximate 28 kDa protein. The P32 protein will be further used for producing primary antibodies in immunohistochemistry for the diagnosis of lumpy skin disease.

Keywords: Lumpy skin disease virus (LSDV), P32 protein

Characterization of chitinolytic bacterium *Serratia marcescens* Mc_G07 isolated from termite guts and molecular cloning of chitinase gene

Torphan Vitoonpanyakij, Kittipong Chanworawit and Pinsurang Deevong*
Department of Microbiology, Faculty of Science, Kasetsart University, Bangkok, Thailand
fsciprd@ku.ac.th

Pinsurang Deevong, Kasetsart University, fsciprd@ku.ac.th

There is a great diversity of microbial communities in the gut of termite, and these microorganisms have the ability to produce various enzymes for biodegradation. Ten isolates of chitinase-producing bacteria from the guts of wood-feeding termite *Microcerotermes* sp were collected and used in this study. Among all isolates, the isolate Mc_G07 presented highest chitinolytic activity and it was identified. Based on analysis of 16S rRNA gene sequences and biochemical characterization (using API 50CHB and API 20E systems), this isolate was closely related to several strains of *Serratia marcescens* with 100% nucleotide identity and 99.9% similarity, respectively. An antifungal assay was performed against 3 pathogenic fungi *Fusarium oxysporum*, *Curvalaria lunata* and *Colletotrichum capsici*, and found that *S. marcescens* Mc_G07 could inhibit fungal mycelial growth of all tested fungi. Moreover, this study investigated the chitinase-encoding gene *chiB* (~1,500 bp) of *S. marcescens* Mc_G07 using gene cloning in *Escherichia coli*. The nucleotide and amino acid sequences of the *chiB* gene were analyzed, and the results revealed that the *chiB* gene showed 99.87% nucleotide similarity to the chitinase-encoding gene and the amino acid sequence was 100% identical to the chitinase B protein of *S. marcescens*. This study indicated that *S. marcescens* Mc_G07 isolated from the termite guts has ability in the production of chitinase and its *chiB* gene was successfully investigated using gene cloning. The results of this study will lead to molecular biotechnology research in the future.

Keywords : Chitinase-producing bacteria, Gene cloning, *chiB*, *Serratia marcescens.*

Cloning and expression of avian influenza virus H3N2 nucleocapsid protein

Navaporn Kamjadphai*
Kasetsart University, Bangkok, Thailand navaporn.kam@ku.th

Salisa Suchitwarasan Kasetsart University fscisssp@ku.ac.th

Avian influenza, also known as 'bird flu' is a disease caused by influenza type A virus in Orthomyxoviridae family. Avian influenza can infect humans and many animals such as horses, pigs, cats, birds, chickens, etc. The spread of avian influenza has caused significant economic in many countries. In Thailand, the loss of poultry exports is more than 60,000 million baht and a large number of patients died. It also affects the local chicken industry, more than 60 million chickens have been killed. Currently, some bird flu viruses have been reported to cause disease in humans such as H1N1, H2N2, H3N2 and H5N1 etc. In general, avian influenza virus infection requires a period of 3-4 day for diagnostic. The standard method for diagnosis is the method of isolating virus in chicken eggs or cultured cells and PCR. Then, the properties of isolate are detected by using chicken red blood cells (hemagglutination, HA) and non-inhibit with antiserum to the Newcastle virus (hemagglutination inhibitor, HI). However, nowadays serological assay is brought to use in active surveillance making it possible to rapid response against an outbreak.

Therefore, the purpose of this research is to produce a recombinant protein nucleocapsid for using in the serological by increasing the number of target genetic material, clone into the expression vector for protein expression in bacteria. It is found that the recombinant protein nucleocapsid is accurate in size and it can be expressed in *E. coli*. The serum of infected animals can be detected. This recombinant protein has a potential candidate to use as an antigen in ELISA.

Keywords : Avian influenza, PCR, recombinant protein nucleocapsid, expression vector.

Isolation of *Ustilago maydis* from infected maize plants as a model for genetic studies and bioproduct production

Nanthikan Sriwong*
Kasetsart University, Bangkok, Thailand nanthikan.sr@ku.th

Chetsada Pothiratana Kasetsart University fscicsd@ku.ac.th

Ustilago maydis is a smut fungus infecting maize that shows less epidermic in Thailand than those in other countries. Smut fungi have been studied for long time in genetics biochemistry and biotechnology as a representative for study of the fungal phytopathogenecity, genetic model and biotechnological applications. This study aimed to isolate smut fungi from infected maize in Thailand using suitable medium and conditions for teliospore germination and sporidia growth. The sexual reproductive system was studied by mating test between two strains and pheromone responses by confrontation assay. The bioproduct production, such as glycolipid was preliminary screened based on surfactant and emulsifier properties. The results showed that teliospores properly germinated on yeast nitrogen base agar amino acids agar and 20% lactose at 28 °C for 12-18 h, leading to total of 26 isolated strains of *Ustilago maydis*. However, sexual mating and conjugation hyphae formation responding to pheromone from compatible mating partner were not observed in all 26 strains. Interestingly, there were two strains showing high glycolipid production potentially for further study on glycolipid production and application.

Keywords: Teliospore, Glycolipid, Surfactant, Emulsifier

Isolation and Characterization of Fungi with Amylase activity from Loog Pang Satho

Buntarika Thaiyakron
Department of Microbiology, Faculty of Science,
Kasetsart University, Bangkok, Thailand buntarika.t@ku.ac.th

Piyangkun Lueangjaroenkit*
Department of Microbiology, Faculty of Science, Kasetsart University piyangkun.lu@ku.th

Satho is a rice wine traditional fermentation made of sticky-rice fermented by loog pang. Molds that help in fermentation and mostly found in loog pang were *Amylomyces rouxii*, *Rhizopus* sp., *Aspergillus* sp. And *Mucor* sp. However, the contamination from the other microorganism had worsen the quality of Satho. Accordingly, this study aimed to isolate the mold which could produce amylase enzyme and used it as the starter culture for the high quality Satho. The loog pang samples were collected from Sak thong spirits community and Ma Bua Nguen spirits community in Phrae province. The fungi were classified by their morphology and identified in molecular level to select the species which will be used in satho fermentation as a pure culture. As a result, we found 23 isolates from the samples, 13 isolates from Sak thong and 10 isolates from Ma Bua Nguen. Mainly fungi were found as belong to *Rhizopus sp.*, *Mucor indicus*, *Aspergillus* in Nigri section and contaminated *Penicillium citrinum.* In the fermentation test, *Rhizopus* sp. D1 had the best candidate due to high amylase activity and provide optimal pH for yeast growth.

Keywords: Loog pang, Satho, Amylase, Fermentation, *Rhizopus*, *Aspergillus*, *Mucor*

Isolation and characterization of chitinolytic actinomycetes from crab shell and soft shell crab pond

Paphitchaya Chokruai, Chirath Pitakkhuamdee, Kittipong Chanworawit, Pinsurang Deevong*
Department of Microbiology, Faculty of Science, Kasetsart University, Bangkok, Thailand
fsciprd@ku.ac.th

Pinsurang Deevong, Kasetsart University, fsciprd@ku.ac.th

This study aimed to isolate and characterize chitinolytic actinomycetes from crab shell, soil and water in soft shell crab pond in Chanthaburi province, Thailand. A total of 18 isolates of actinomycetes (2, 11 and 5 isolates from crab shell, soil and water samples, respectively) showed chitinolytic ability on colloidal chitin agar (CCA) containing 1% colloidal chitin. Isolate S2 obtained from soil sample presented highest chitinase activity with chitinolytic index of 2.06 ± 0.24. Based on identification of 16S rRNA gene sequence, the isolate S2 was identical to strains in the genus *Cellulosimicrobium* (100% identity) and it exhibited highest chitinase activity of 0.28 U/mL using Shales's method. The chitinolytic actinomycetes isolated in this study will be useful in biotechnology study in the future.

Keywords: Chitinolytic actinomycete, Chitinase, Chitin, Soft shell crab.

Isolation and characterization of chitinolytic bacteria from amphipod species for biological control against anthracnose disease caused by *Colletotrichum capsici*

Poramet Chuglum, Chinnaphat Meeto, Kittipong Chanworawit, Piyangkun Lueangjaroenkit and Pinsurang Deevong*
Department of Microbiology, Faculty of Science, Kasetsart University, Bangkok, Thailand
fsciprd@ku.ac.th

Pinsurang Deevong, Kasetsart University, fsciprd@ku.ac.th

Pathogenic fungi are a major problem in crops. A variety of alternatives to agrochemical use already exist. Microbial chitinases are gaining interest as promising candidates for controlling plant pathogenic fungi due to their ability to degrade chitin in the fungal cell wall. The objectives of this research were to isolate chitinase-producing bacteria from three amphipods: *Grandidierella* sp. (GG), *Quadrivisio* sp. (QM), and *Floresorchestia* sp. (FA). In this study, a total of 12 chitinolytic isolates were tested for chitinase and antifungal activities against plant pathogenic fungi. High chitinase activities were found in the isolates GG-C6, QM-E1, QM-T4, and FA-E1, and their 16S rRNA gene sequences were closely related to bacterial strains of *Aeromonas enteropelogenes* (99.59% identity), *Aeromonas caviae* (99.80% identity), *Aeromonas taiwanensis* (99.32% identity), and *Aeromonas dhakensis* (99.86% identity), respectively. Their safety was preliminary tested, and non-hemolysis was found on sheep blood agar. Hyphal damage and swelling of the inhibited mycelium could be observed by scanning electron microscope (SEM). After ultrafiltration of chitinase, the isolate FA-E1 showed the highest specific enzyme activity of 4.72 ± 0.01 U/mg total protein. Mycelial growth inhibition by bacterial cultures and concentrated chitinase enzymes against *Colletotrichum capsici* (which causes anthracnose disease in red chili *Capsicum frutescens*) showed that the isolate QM-E1 has the highest inhibition of 61.56 ± 0.25% and 65.56 ± 0.13%, respectively, followed by the isolates QM-T4, GG-C6, and FA-E1 (with 53.56%, 53.30%, and 51.65% for bacterial cultures; and 55.19%, 54.64%, and 52.00% for chitinase enzymes, respectively). The results of this research suggested that chitinolytic bacteria isolated from amphipods and their chitinases have potential for biological control against plant pathogenic fungi.

Keywords: Chitinase-producing bacteria, Amphipod, Biological control, Anthracnose disease.

Screening of antimicrobial activities of *Phyllanthus amarus* extract

Pattarawut Puttakul*
Kasetsart University, Bangkok, Thailand pattarawut.p@ku.th

Tanes Sangsri
Princess of Naradhiwas University, Naradhiwas, Thailand

Patcharaporn Siwayaprahm Kasetsart University fscippsp@ku.ac.th

The antimicrobial activity of *Phyllanthus amarus* extract was investigated in inhibiting some microorganisms such as enteropathogenic bacteria, yeast and fungi. Crude extracts of *P. amarus* were prepared with aqueous and ethanolic extracts and evaluated for their growth inhibitory activity by agar well diffusion method. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were determined by the broth dilution method. The results showed that the aqueous and ethanolic extracts could inhibit the growth of *Salmonella* Typhimurium, *Escherichia coli*, and *Enterococcus faecalis*. The MIC value of *P. amarus* extracts tested against *E. coli* was 125,000 ppm and the MBC value was 250,000 ppm. Furthermore, the ethanolic extract was shown to be more effective than the aqueous extract. Neither aqueous nor ethanolic extract could inhibit the growth of *Candida albicans*, which was contrast that all crude extracts were able to inhibit the growth of *Aspergillus flavus*. The phytochemical compounds identified by thin layer chromatography analysis were showed that there were quercetin and gallic acid incorporated in both extracts. Scanning electron microscope analysis revealed that the aqueous and ethanolic *P. amarus* extracts could make damages to *E. coli* cells.

Keywords: *Phyllanthus amarus*, enteropathogenic bacteria, quercetin, gallic acid.

The ability of yeasts to produce xylitol and alcohol using xylose

Maneerat Khammeankea*
Kasetsart University, Bangkok, Thailand maneerat.k@ku.th

Pannida Khunnamwong Kasetsart University fscipik@ku.ac.th

Xylitol is used as sweetener in substitution of sugar, which is a non-caloric and non-cariogenic sweetener. Due to its physicochemical, functional and nutritional properties, xylitol has been gaining importance in different manufacturing industries. In the xylitol manufacturing process, the direct production of xylitol from natural extraction or chemical process is limited in quantity and quality. Thus, the objectives of this study were (1) to investigated the ability of yeast isolated from *Rhynchophorus* sp. intestines to produce xylitol and alcohol from xylose, (2) to evaluate ability of yeast to produce extracellular enzymes, and (3) identify the isolated yeasts based on molecular taxonomy. The osmotolerant test demonstrated that all 29 strains were grown on yeast extract peptone (YP) agar containing with 20% xylose, but not on YP agar with 40% and 60% xylose. Analysis of the sequences of the D1/D2 domains of the large subunit (LSU) rRNA gene showed that 24 strains were identified to be three species namely *Candida tropicalis* (15 strains), *Trichosporon siamense* (8 strains) and *Apiotrichum mycotoxinovorans* (1 strain). None of the yeast strains could produce ethanol from xylose, but 10 yeast strains, *C. tropicalis* (7 strains) and *T. siamense* (3 strains), produced xylitol in range of 3-5 g/l in yeast nitrogen base (YNB) containing with 2 % (v/w) xylose, and 20-31 g/l in YNB containing with 10 % (v/w) xylose, with the highest xylitol produced by *Candida tropicalis* DMKU-CXE2. In addition, the production of cellulases, caseinase, xylanase, pectinase, amylase, protease and lipase were investigated and revealed that 25 strains produced lipase, with *Trichosporon siamense* DMKU-CXE15 showing the highest lipase activity.

Keywords: Xylitol, Ethanol, Xylose, Yeast, Extracellular enzyme

The ability of yeast to produce Erythritol and Extracellular enzymes

Sittipon Yakamna*
Kasetsart University, Bangkok, Thailand sittipon.y@ku.th

Pannida Khunnamwong Kasetsart University fscipik@ku.ac.th

Erythritol, a naturally occurring sweetener found in foods like fruit, fungi, seaweed, and fermented foods, has no calories, no carcinogens, and is safe for diabetics. Has a variety of qualities, such as nutritional worth erythritol is used at various industrial levels, although at the present time, the quantity and quality of erythritol produced directly are still constrained. Therefore, the purpose of this study is to learn more about the synthesis of erythritol by yeast as well as the development of extracellular enzymes. Incorporating molecular taxonomy-based classification. In this study, 100 yeast strains' ability to grow on yeast extract peptone (YP) agar media at various glucose concentrations was determined. It was discovered that 27 strains could grow on all media concentrations. 20 yeast strains could be identified through an analysis at the D1/D2 nucleotide sequences of the large subunit (LSU) rRNA gene. 7 genus includes 6 known species and 7 undiscovered species. *Rhodotorula toruloides* was the most prevalent yeast in the study (55%). On a basal medium containing 10% glucose, thin layer chromatography was used to study the biosynthetic capacity of erythritol, and high performance liquid chromatography was used for confirmation of the results. All of the strains examined had none erythritol production, it was discovered. However, it was discovered that at least 26 strains have produced at least one type of extracellular enzyme during the research of this process and Out of the 26 strains examined, *Aureobasidium* sp. DMKU-PAL26 and *Sarocladium* sp. DMKU-PAL100 produced up to 5 extracellular enzymes, including pactinase, lipase, amylase, caseinase, and endoglucanase.

Keywords: erythritol, thin layer chromatography, high performance liquid chromatography, extracellular enzyme

Development of low-fat cheesecake with synbiotic properties.

Sukullaya Soonthornrohit
Kasetsart University, Bangkok, Thailand sukullaya.s@live.ku.th

Rachatida Det-udom Kasetsart University fscirid@ku.ac.th

Cheesecake is one of the most popular desserts, especially of female. Nevertheless, high cholesterol and sugar characters of this product are in concerned. Therefore, the objectives of this research were 1) optimization of cream cheese-like Greek yoghurt customized for low-fat cheesecake production, 2) determination of prebiotic effect toward growth and viability of probiotic including in derived products from 1), and 3) examination of probiotic properties in cheesecake based on survivability. Viability of both lactic acid bacteria and *Bacillus coagulans* in yoghurt fermentation process proved symbiosis interaction between them. Thus, 4 yoghurt formulations were created. Among all, recipe 3 (yoghurt + *B. coagulans*) and 4 (yoghurt + *B. coagulans* + inulin 2%) gave a remarkable stability and were selected for low-fat cheesecake production. An approach of high-protein, low calorie cheesecake was confirmed. However, further research needed.

Keywords: *Bacillus coagulans*, Lactic acid bacteria, Probiotics, Synbiotics, Low-fat cheesecake.

Study of antioxidant production and antibacterial activities of *Hericium* spp. crude extract

Sutthathip Panyada*
Kasetsart University, Bangkok, Thailand Sutthathip.pa@ku.th

Yaovapa Aramsirirujiwet Kasetsart University fsciypt@ku.ac.th

Lion's mane mushroom (*Hericium erinaceus*) contains rare compounds that are good for the brain, can help reduce age-related forgetfulness in people aged 50-80 years, and there are two important substances in monkey head mushrooms such as erinacines and hericenones, which can protect nervous system that stimulates the growth of cells in the nerves involved in the maintenance of neurons in the brain prevent dementia brain disorders, Alzheimer's disease, depression and muscle weakness including anti-oxidants to prevent the risk of cancer. It also has antibacterial activity that can cause many types of diseases. The purpose of this research was to study the antioxidant activity and antibacterial ability of *Hericium* spp. grown at 15 °C (HC) and 37 °C (HH) crude extract. From the test for antioxidant activity, we found that HC and HH crude extract had IC_{50} values of 10. 3579 mg/ml and 17.6256 mg/ml, respectively. In terms of the total phenolic content, HC and HH crude extract at concentrations of 2, 3, 4, 5 mg/ml had values of 0.366, 0.982, 1.580, 2.469 mg gallic acid equivalents/g of extract and 0.449, 0.805, 1.5640, 2.586 mg gallic acid equivalents/g of extract, respectively. The highest FRAP values of HC and HH crude extract were 6.2069 nmol and 5.6322 nmol, respectively. From the test of antibacterial activity, we found that HC and HH crude extract inhibited gram-negative bacteria such as *P. aeruginosa* and *E. coli* better than gram-positive bacteria such as *S. aureus.*

Keywords : *Hericium erinaceus*, Antioxidant activity, Total Phenolic content, Antibacterial activity, FRAP assay, Crude extract

Study of antioxidant production and antibacterial activities of mushroom crude extract from *Pleurotus eryngii* and *Pleurotus citrinopileatus* Singer

Supharat Paenthong*
Kasetsart University, Bangkok, Thailand Supharat.pa@ku.th

Yaovapa Aramsirirujiwet Kasetsart University, Bangkok, Thailand fsciypt@ku.ac.th

The aim of this research was to investigate the antioxidant properties of eryngii and golden oyster mushroom crude extracts and their antibacterial activity against *Escherichia coli*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* that may cause disease in humans. Crude extracts from eryngii and golden oyster mushrooms were extracted with 95% ethanol and dried by rotary evaporator. Antioxidant production and total phenolic content were studied by DPPH assay and Folin-Ciocalteu. The study found that the inhibition values from the DPPH test of the eryngii and oyster mushroom extracts were 31.565% and 36.868%, respectively, and the total phenolic content of the eryngii and oyster mushroom extracts were 31.565% and 36.868% respectively, and showed total phenolic content value between 6.287 to 42.060 mg gallic acid equivalent/g dry matter and 3.751 to 22.182 mg gallic acid equivalent/g dry matter, respectively. The result from agar disc diffusion antibacterial activity study, found that the concentration of 1,000 mg/ml of crude extracts from eryngii and golden oyster mushrooms could inhibited the growth of all bacteria. From the MIC test results, it was found that the crude extract from golden oyster mushroom has antibacterial activity against *E. coli* and *S. aureus* with MIC values of 17 and 19 mg/mL, respectively. The golden oyster mushroom extract could inhibited *P. aeruginosa* and *E. coli* with MIC values of 17 and 17 mg/mL, respectively. The MBC values could not be determined by the test. However, these results should be confirmed in further studies.

Keywords: oyster mushroom, golden oyster mushroom, antioxidant activity, content of phenolic compounds, minimum inhibitory concentration

Study of antioxidant production and antibacterial activities of mushroom crude extract from *Agrocybe cylindracea* and *Pleurotus djamor*

Atitiratt Saengpakdee*
Kasetsart University, Bangkok, Thailand Atitiratt.s@ku.th

Yaovapa Aramsirirujiwet Kasetsart University, Bangkok, Thailand fsciypt@ku.ac.th

This research aimed to determine total phenolic contents and antioxidant activity of crude extracts from Yanagi (*Agrocybe cylindracea*) and Pink oyster mushroom (*Pleurotus djarmor*) and also study the ability of these extract to inhibit the growth of 3 bacteria, namely *Staphylococcus aureus, Pseudomonas aeruginosa and Escherichia coli*.The mushroom fruit body were extracted with 95% ethanol and dried. Antioxidant production of the extract was studied by DPPH assay and total phenolic content was determined by Folin-Ciocalteu. The study found that the IC_{50} values from the DPPH test of Yanagi and Pink oyster mushroom extracts were 34.016 mg/mL and 12.905 mg/mL, respectively. The result of total phenolic content of Yanagi and Pink oyster mushroom extract were between 5.85 to 22.67 mg GAE/g DW and 5.166 to 25.11 mg GAE/g DW, respectively. In antibacterial studies by agar disc diffusion method, the result found that at the concentration 1,000 mg/mL of the crude extract from Yanagi mushroom has a bactericidal effect to *Staphylococcus aureus, Escherichia coli and Pseudomonas aeruginosa* which showed the inhibition zone 8.16±0.76, 8.67±0.58 and 8.37±0.57 mm, respectively. The MIC and MBC values could not be evaluated from this experiment. The result from this study found that, the crude extracts from Yanagi mushroom and Pink oyster mushroom are interest to be developed as pharmaceutical compounds in the future. Therefore, further studies should be conducted for further development.

Keywords : *Agrocybe cylindracea*, *Pleurotus djarmor*, Bacteria pathogen, Antioxidant activity, Phenolic content

Antibiofilm and anticancer activities of *Lentinus squarrosulus* extracts cultured in different condition broths

Abigail Kangwan*
Kasetsart University, Bangkok, Thailand abigail.k@ku.th

Ingorn Kimkong Kasetsart University ingorn.k@ku.th

Antibiotic resistance is a significant problem in the medical and public health fields worldwide, including in Thailand. Biofilm-forming pathogenic bacteria are involved in this problem due to the biofilm matrix decreases susceptibility to antibiotics. Besides this issue, breast cancer is the most common cancer in Thai and global women. Even if there is a chance for a cure at an early stage, there may still be side effects from treatment such as chemotherapy and radiation therapy. Therefore, using natural active ingredients instead of those treatments may be safer. *Lentinus squarrosulus* mushroom has various medicinal properties such as antibacterial and anticancer activities. This mushroom contains polysaccharides, which can be produced by growing the mushrooms in a liquid medium. In this research, the extracts from the cultivation of *L. squarrosulus* mycelium in Malt Czapek Broth (MCzB) at static and shaken conditions were selected to test their ability against biofilm formation of pathogenic bacteria by crystal violet assay. Moreover, the extract from the cultivation of *L. squarrosulus* mycelium in Czapek Yeast autolysate broth (CzYB) was used to test its activity against MCF-7 breast cancer cells by CCK-8 assay. The results showed that the *L. squarrosulus* extracts cultured in MCzB in a static condition were able to inhibit the biofilm formation of Methicillin-resistant *staphylococcus aureus* (MRSA) and *Pseudomonas aeruginosa.* Moreover, *L. squarrosulus* extracts cultured in CzYB medium showed the inhibitory activity against MCF-7 cells with dose- and time-dependent effect after treatment for 72 hours with the IC_{50} value was 151.398 µg/ml.

Keywords: Antibiotic-resistant bacteria, Biofilm, Breast cancer, *Lentinus squarrosulus*

Study of antioxidant production and antibacterial activity in crude extract from mycelia and fruiting bodies of *Ganoderma* sp.

Konthida Thimrot*
Kasetsart University, Bangkok, Thailand Konthida.th@ku.th

Yaovapa Aramsirirujiwet Kasetsart University, Bangkok, Thailand fsciypt@ku.ac.th

This research was investigated on the antioxidant production and ability to inhibition the growth of 3 bacterial species, *Escherichia coli*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* of the crude extract from mycelia and fruiting bodies of *Ganoderma* sp. The mushroom fruit body was collected from the area around Kasetsart University, Bangkok. The mycelia and fruit body of *Ganoderma* was extracted with 95% ethanol and dried by rotary evaporator. The crude extracts were studied for antioxidant production by DPPH assay, total phenolic content determination by Folin-Ciocalteu and study for ferric reducing ability by FRAP method. The study found that the IC_{50} from the DPPH test were 0.9551 mg/ml and 4.3571 mg/ml in fruit body and mycelium extract, respectively. The total phenolic content of the crude extract from fruiting bodies was 10.9229 - 77.6854 mg Gallic/g DW, and total phenolic content was 6.5766 - 46.8439 mg Gallic/g DW in the crude extract from mycelium. In the study of the ability to reduce ferric by FRAP method, it was found that the FRAP value from crude extract of fruit body was higher than that of mycelium crude extract. The values of FRAP of fruit body extract were 7.587 – 48.793 nmoles, and FRAP values of mycelium extract were 3.571 – 13.793 nmoles. The FRAP values of both extracts were increased according to the concentration level. The antibacterial activity was studied by agar disc diffusion method. The result found that at the concentration of 1000 mg/ml, fruiting bodies crude extract slightly inhibited the growth of *E. coli* and *S. aureus*. The mycelium crude extract could slightly inhibited the growth of all 3 types of bacteria. Unfortunately, this experiment could not determined the MIC and MBC values. From the resulted studies here, it is interesting that the extract from fruiting bodies of *Ganoderma* sp. showed high antioxidant efficiency. More research is required for this extract.

Keywords : *Ganoderma* sp., antibacterial activity, antioxidant, crude extract

Healthy Snack Alternatives product : vegan probiotic date gummy

Kawintra Srisaard
Kasetsart University, Bangkok, Thailand kawintra.sr@live.ku.th

Rachatida Det-udom Kasetsart University fscirid@ku.ac.th

Nowadays probiotic products gain more attention due to their health-promoting properties. However, commercialized probiotic products such as yoghurt could not fulfill the need of vegan consumers. There was also a gap in child to teen marketing that this probiotic snack could be show up. Date is now a popular economic plants among Thai agriculturists due to its fast-growing and high production yield. In another way, without government restriction, oversupply is one of the major problems of this crop. Therefore the objectives of this research were development of new probiotic snack using date as a main ingredient in order to deal with overflow issue and promoting value-added products as well. The outcome was designed in gummy-type bites supplemented with probiotic microorganisms *Bacillus coagulans*. The microbe was selected by its remarkable high stability spore-producing property. Optimization of probiotic gummy recipe included 20% date juice, 80% R.O. water, 1% tamarind paste, 1.5% sodium alginate, 0.5% sodium citrate and 0.5% psyllium husk with gelation by spherification technique.

Keyword: Probiotic products, Date gummy, Spherification.

Production of bacterial cellulose with antibacterial activities through single and co-culture fermentation of *Komagataeibacter* and lactic acid bacteria

Kesadaporn Sittikamtab*
Kasetsart University, Bangkok, Thailand Kesadaporn.s@ku.th

Uraiwan Tippayasak Kasetsart University uraiwanmasud@yahoo.com
Gunjana Theeragool Kasetsart University fscignt@ku.ac.th

Bacterial cellulose (BC) is a glucose polymer derived from bacterial fermentation, for example acetic acid bacteria especially *Komagataeibacter*. Presently, bacterial cellulose is getting more and more attention to replace the use of plant cellulose due to its many better properties such as high purity, good water holding capacity, high flexibility, high polymerization rate, good biocompatibility and can be easily decomposed. It is suitable to be used in the food, cosmetic and medical industries. For lactic acid bacteria, they can produce bacteriocin which has similar antibacterial activity with antibiotics. In this study, we produced bacterial cellulose with antibacterial activities through co-culture fermentation of three thermotolerant acetic acid bacteria (*K. oboediens* MSKU 3 isolated from bananas, *K. oboediens* RC37-23 a low-nutrient adapted strain of *K. oboediens* R37-9 and *K. xylinus* MSKU 12 isolated from rose apple) with lactic acid bacteria. The aims of this study are to select low-cost medium and suitable condition for production of bacterial cellulose with antibacterial activities. It was found that low-cost coconut water medium containing 0.5% acetic acid, 3% sucrose and 0.5% ammonium sulfate (CW0.5A3S0.5N) was appropriate culture medium for production of bacterial cellulose. Determination of antibacterial activities by disc agar diffusion method indicated that antibacterial activities were mainly from bacterial cellulose not culture broth containing acetic acid and/or lactic acid. Moreover, bacterial cellulose from co-culture fermentation exhibited better antibacterial activities than the one from single culture fermentation. *K. oboediens* MSKU 3 and *K. oboediens* RC3 7- 2 3 were appropriate strains for co-culture fermentation with *Lactobacillus paracasei* TBRC 6943 and *Pediococcus pentosaceus* whereas *K. xylinus* MSKU 12 was suitable for co-culture fermentation with *P. pentosaceus* (LAB 14-7) and *P. pentosaceus* in CW0.5A3S0.5N medium. Among 5 tested bacterial strains (*Bacillus cereus* ATCC 11778, *Staphylococcus aureus* ATCC 29213, *Escherichia coli* ATCC 35219, *Salmonella typhimurium* ATCC 14028 and *Shigella sonnei* ATCC 25931), *S. aureus* ATCC 29213 was the most sensitive to bacterial cellulose from co-culture fermentation.

Keywords: bacterial cellulose, acetic acid bacteria, lactic acid bacteria, antibacterial activities, inhibition zone

Extraction and Utilization of Hydrophobin Class I for Coating Fabrics and Fiber Used in Daily Life.

Chanitsiree Khunprada*
Kasetsart University, Bangkok, Thailand chanitsiree.k@live.ku.th

Chetsada Pothiratana Kasetsart University fscicsd@ku.ac.th

Hydrophobins are small proteins containing eight conserved cysteine residues linked by the disulfide bond, found only in filamentous fungi and mushrooms. They are amphipathic containing hydrophilic and hydrophobic parts in molecules. Therefore, they have been used for various purposes, such as surface modification. The objectives of this research were to study hydrophobin extraction methods from mycelia of Split gill mushroom (*Schizophyllum commune*) and Lingzhi mushroom (*Ganoderma lucidum*) and properties of hydrophobin for surface modification of fabrics and fibers. The results showed that the production yields and protein concentration of hydrophobin Class I crude extracts from Split gill were 9.7 mg/g dried mycelia weight, and 731.8 ug/ml, respectively. The production yields and protein concentration of hydrophobin Class I crude extracts from Lingzhi mushrooms were 8.3 mg/g dried mycelia weight and 692.8 mg/ml, respectively. Hydrophobin extracts from Split gill mushroom contained bands of expected hydrophobin proteins in the range of molecular weight 20-37 kDa, while Lingzhi mushroom's hydrophobin extracts contained two expected protein bands at 9.11 and 11.2 kDa. The obtained hydrophobin extracts were studied their properties for surface modification of fabrics and fibers on cotton, linen, and TC fabrics. The results showed that coated linen fabrics with hydrophobins showed significantly increasing water absorbing time while its cotton fabrics showed no difference. Although TC fabrics coating showed the longest water absorbing time and highest WCA, however, not directly from hydrophobin. Hydrophobin was tolerant to SDS treatment only when coated on linen fabrics. The suitable pH for coating fabrics is acidic pH of hydrophobin extract.

Keywords: Hydrophobin Class I, Water Contact Angle, cotton fabric, linen fabric, TC fabric.

Screening of microalgae *Schizochytrium* spp. for DHA production

Thanaporn Ruhathawonkun*
Kasetsart University, Bangkok, Thailand thanaporn.ruh@live.ku.th

Duenrut Chonudomkul Kasetsart University fscidrc@ku.ac.th

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 mangrove forests that were screened. The aim of the current study was to find isolates capable of producing high amounts of DHA unsaturated fatty acids by being compared with *Schizochytrium* sp. SMT 9-30. Four hundred fifty-five isolates of *Schizochytrium* spp. were isolated and screened from mangrove forests, which were collected from Thailand. The results showed that all isolates were able to produce DHA. In the secondary screen of 58 isolates, 3 isolates were found to produce more than 43% of DHA total fatty acid and produce higher than *Schizochytrium* sp. SMT 9-30. The tertiary screen showed that isolate 4-12 had the highest DHA production and was 1.9 times higher than that of *Schizochytrium* sp. SMT 9-30 and in the same way, DHA content (%) is higher than *Schizochytrium* sp. SMT 9-30 1.8 times. Therefore, *Schizochytrium* spp. isolates 4-12 with high DHA production capacity can be studied and developed to replace DHA from marine fish in the future.

Keywords: DHA, *Schizocytrium* spp., Microalgae, Thraustochytrids

Improvement of *Calocybe indica* mycelia and anti-acne causing bacteria by submerged cultivation supplemented with napier grass juice

Thawanrat Saengthong*
Kasetsart University, Bangkok, Thailand thawanrat.sa@ku.th

Churapa Teerapatsakul
Kasetsart University, Bangkok, Thailand. fscicpt@ku.ac.th

Currently, the attempts to search an alternative treatment for acne from natural resources have been considerably expanded due to the antibiotic resistance of acne-inducing bacteria and skin side effects. Mushrooms have been recognized as an important source of natural bioactive compounds that are increasingly utilized as cosmeceutical ingredients. Therefore, this research focused on antibacterial activities against the bacteria triggering inflammatory acne such as *Cutibacterium acenes*, *Staphylococcus epidermidis* and *S. aureus*. Ethanolic mycelium extract derived from of *Calocybe indica* in submerged culture supplemented with napier grass juice was examined for the antibacterial activities. Minimal inhibitory concentration (MIC) and minimal bactericidal concentration (MBC) values were evaluated by broth dilution assay. Napier grass juice improved mycelial biomass production and the antibacterial activities of *C. indica*. The extract inhibited the bacterial growth by disrupting the bacterial cell wall. Therefore, the extracts of *C. indica* mycelia could be developed into anti-acne cosmeceutical.

Keywords: *Calocybe indica*, Mushroom mycelia, Submerged cultivation, Napier grass juice

Leather-like Material Biofabrication from Mushroom Mycelia

Pawarisa Wasukree*
Kasetsart University, Bangkok, Thailand pawarisa.was@live.ku.th

Yaovapa Aramsirirujiwet Kasetsart University fsciypt@ku.ac.th

Chetsada Pothiratana Kasetsart University fscicsd@ku.ac.th

Mushrooms are belonging to Fungi Kingdom. In nature, fungi play an important role as an efficient decomposer, which can be applied for conversion of agricultural wastes into biomaterials. The purpose of this study was to produce leather-like materials from mushroom mycelia, including studying suitable growth conditions, light condition during incubation, sawdust quantity and types of plasticizers used. In this study, the mushroom used was *Lentinus* sp. strain KU091 and the agricultural waste used was sawdust. When mushroom mycelia were cultivated and fully grew in sawdust bags, then packed into boxes at 3 levels: 100 g, 200 g and 300 g, and incubated in 4 conditions: dark, normal light (day/night), dark switch to normal light (day/night) and normal light (day/night) switch to dark. It was found that 300 grams of sawdust mushroom starter had uneven growth of mycelia on the surface, making unpleasant and incomplete sheet of leather-like materials. The sawdust starter at the level of 100 g, and 200 showed smooth mycelial growth on a surface, thus making more pleasant materials. The incubation conditions in dark switch to normal light (day/night) yielded the highest values of Young's modulus of materials. Therefore dark switch to normal light (day/night) incubation conditions. and sawdust starter quantity at 100 g and 200 g were used for the next experiment. Three types of plasticizers were tested, namely PEG400 20%, PEG400 40% and glycerol 30%. When measuring the tensile force, PEG400 20% treated material gave the highest values of Young's modulus.

Keywords: mushroom mycelia, sawdust, plasticizers

Effects of inoculant biofertilizers: Diversity and effect on rice growth

Pattamaporn Pumkeaw*
Kasetsart University, Bangkok, Thailand pattamaporn.pumk@ku.th

Salisa Suchitwarasan Kasetsart University fscisssp@ku.ac.th

This study used three types of biofertilizers such as 1. Root growth mycorrhizal fungi (R1), 2. Root growth mycorrhizal fungi 2 (R2), and 3. TNC mycorrmax (TNC) to grow in combination with two rice cultivars, 105 and RD15. The aim of this study is to investigate the number and diversity of fungi from all three biofertilizer samples as well as the effects of biofertilizers on rice seedling growth and the growth under greenhouse conditions. This rice variety 105 is the most suitable for planting with fungal biofertilizer. The fungal diversity results from NGS (next generation sequencing) by using the primers ITS1 and ITS4 illustrate that the main fungal phylum colonizing in the rice root planting with R1 biofertilizer is Ascomycota followed by Basidiomycota. The fungi in the class Sordariomycetes of the order Sordariales were the most numerous group colonized in root compared to the control treatments. The selection of the best fertilizer for rice seedling growth shows that R2 was the best biofertilizer to promote the rice growth in the greenhouse condition. There was a significant increase in the fresh weight of rice plants compared to the control treatment. Both biofertilizers were able to promote root length, plant fresh weight, root fresh weight, and plant dry weight when compared to the control treatment. Therefore, it can be concluded that cultivating rice plants with biofertilizers promotes the growth of rice plants in this study.

Keywords: Diversity, Biofertilizers, Rice

Actinomycetes from *Sesuvium portulacastrum* and *Sporobolus virginicus*, and their plant growth promoting activity to promote duckweed growth

Peeraya Boonchu*
Kasetsart University, Bangkok, Thailand peeraya.b@ku.th

Kannika Duangmal Kasetsart University fscikkd@ku.ac.th

Actinomycetes are a group of Gram-positive bacteria, which have ability to promote plant growth. This study was aimed to isolate actinomycetes from halophytes, detected their plant growth promoting activity and the ability of the isolates to promote duckweed growth. A total of 27 actinomycetes were isolated from leaves and rhizosphere soils of *Sesuvium portulacastrum* and *Sporobolus virginicus* using starch casein agar. Morphological characteristic and diaminopimelic acid (DAP) isomers revealed that they were separated into 4 groups based on spore color grouping on ISP3 agar. Grey spore was dominant group (59.3%). Based on DAP types, 26 isolates were assigned into group of *Streptomyces*. The detection of siderophore production and phosphate solubilization activity of these 27 isolates showed that all isolates produced siderophore, whereas 8 isolates solubilized phosphate. Five isolates (SpL2-1, SpL2-5, SpR1-4, SeS2-2 and SeS2-5) which showed good ability of siderophore production and phosphate solubilization activity were selected for co-cultivation with duckweed *Spirodela polyrhiza*. The result showed that isolate SpL2-1 gave the highest promotion to duckweed growth, which frond numbers were increased up to 1.06-fold when compared to the control. Identification of isolate SpL2-1 using 16S rRNA gene sequence showed that isolate SpL2-1 shared 99.4 % similarity with *Streptomyces fractus* (FJ8579947).

Keywords: Actinomycetes, Halophytes, *Sesuvium portulacastrum*, *Sporobolus virginicus*, Duckweed, Plant growth promoting activity.

Optimization of superfine bacterial cellulose production in coconut water by *Komagataeibacter oboediens* RC37-23

Monthana Khumprem*
Kasetsart University, Bangkok, Thailand monthana.k@ku.th

Uraiwan Tippayasak Kasetsart University uraiwanmasud@yahoo.com

Gunjana Theeragool Kasetsart University fscignt@ku.ac.th

Komagataeibacter is an acetic acid bacterium which can produce acetic acid and bacterial cellulose but sensitive to high temperature so it requires fermentation temperature control between 25-30 °C for growth and production of various products. From previous work, thermotolerant acetic acid bacterium, *K. oboediens* MSKU 3 isolated from banana can produce acetic acid and bacterial cellulose at 37 °C. MSKU 3 was adapted to high ethanol concentration and the adapted strain E 3 was selected. This strain lost ability to produce bacterial cellulose which was restored in R37-9 by static cultivation of E3 in culture medium without ethanol supplementation at 37 °C. The bacterial cellulose fibril produced from *K. oboediens* R37-9 was superfine and had potential to be a raw material for biofilm production but its cost was high. Therefore, *K. oboediens* R37-9 was studied for low-nutrient adaptation in coconut water medium. *K. oboediens* RC37-23 was isolated from static cultivation at 37 °C. The aim of this study is to optimize bacterial cellulose production by statistical design and analysis. The experiments with the Plackett-Burman design showed that sucrose, acetic acid, and time significantly affected bacterial cellulose production yield in a coconut water medium at 37 °C. Based on the Central composite design-Response surface methodology, the maximum bacterial cellulose yield was 3.51 g/L dry weight, obtained from static fermentation in a coconut water medium containing 3.5% sucrose, 1% acetic acid and incubated for 9 days at 37 °C. The amount of bacterial cellulose production increases as sucrose, acetic acid, and time increase. The validation method is used to study optimum conditions. The highest experimental and predicted dry weight of bacterial cellulose yields were 3.07 and 3.03 g/L dry weight, respectively. In addition, the highest experimental and predicted productivity of bacterial cellulose yield were 0.3406 and 0.3367 g/L dry weight/day, respectively. Both dry weight and productivity of bacterial cellulose yield from the experiment was higher than the predicted value in coconut water medium consisting of 3% sucrose, 1% acetic acid, and incubated for 9 days.

Keywords: acetic acid bacteria, *Komagataeibacter oboediens*, bacterial cellulose, Plackett-Burman design, Central composite design

Isolation and identification of fungal endophyte from rare and endangered lady's slipper orchid, *Paphippedilum* spp. (*Orchidaceae*)

Ramone Uttamavetin*
Kasetsart University, Bangkok, Thailand ramone.u@ku.ac.th

Piyangkun Lueangjaroenkit Kasetsart University piyangkun.lue@ku.ac.th

Lady's slipper orchid is one of rare and endangered plant due to their physiology and habitat that are difficult for them to survive in nature. It is therefore necessary to rely on mycorrhizal fungi to promote the growth and improve survival rate of the orchids. This study aimed to isolate, identify endophyte and mycorrhizal fungi from the roots of *Paphippedilum* spp. and prove the alternative method to conserve the lady's slipper orchid. Isolation and identification of fungi from 3 lady's slipper orchid as *Paphiopedilum charlesworthii, Paphiopedilum villosum* and *Paphiopedilum godefroyae.* The total of 27 isolates were found, which 9 isolates from *Paph. charlesworthii,* mostly in the genus *Xylaria*. 14 isolates from *Paph. villosum* mostly in the genus *Tulasnella* and 4 isolates from *Paph. godefroyae* were belonging to genus *Irpex, Schizophyllum, Pleosporales* and *Scedosporium.* Symbiotic seed germination (co-culture with mycorrhiza fungi *Epulorhiza* sp. DT4_1) indicated that no seed germination was observed in 2 months, However the co-culture with mycorrhiza fungi *Epulorhiza* sp. DT4_1 with seedling indicate that seedlings co-cultured with DT4_1 had 67% new root germination percentage, which was higher than the control with only 33% new root germination percentage moreover seedlings co-cultured with DT4_1 had over average new root length of seedlings from control. Thus, this study demonstrated opportunity to use fungi for the alternative method to conserve the lady's slipper orchid.

Keywords: *Paphiopedilum* spp., mycorrhizal fungi, seed, germination, seedling, growth

Screening of squalene producing yeasts

Vassana Supapongsri*
Kasetsart University, Bangkok, Thailand vassana.s@ku.th

Noppon Lertwattanasakul
Kasetsart University, Bangkok, Thailand fscinple@ku.ac.th

Squalene is an unsaturated aliphatic hydrocarbon that is important in the dietary supplement industry and cosmetics. It can be found in microorganisms, plants, and animals. The most common source of squalene is deep-sea shark liver oil. Shark populations are currently declining because of the enormous number of sharks being caught for use. And with the increasing demand for squalene, it is necessary to find alternative sources of squalene that are low cost and sustainable. Because yeast grows rapidly, quickly multiplies, and requires less area for cultivation. Therefore, it is desirable to screen squalene producing yeasts for further utilization. Twenty-seven strains isolated from Pang Sida Waterfall, Sa Kaeo Province and 13 strains isolated from solar salterns, Samut Songkhram Province were selected and subjected to lipid extraction and subsequently determined squalene amount by high performance liquid chromatography. Of 40 selected yeast strains, the strain SD10-1 was found to produce the highest squalene of 98.15 mg/L followed by the strains SD28-1 and SD4-3 which produce 88.98 and 88.51 mg/L, respectively. However, the strain with highest squalene producing ability should be further investigated for optimum conditions that can enhance the production of squalene.

Keywords: squalene, yeast, lipid extraction

Isolation and identification of thermophilic bacteria producing chitinase from hot spring in Kanchanaburi Province

Wiparat Worajarubowornsin*, Worrapot Pengpa
Kasetsart University, Bangkok, Thailand Wiparat.wo@ku.th

Patcharaporn Siwayaprahm Kasetsart University fscippsp@ku.ac.th

The objectives of this study were to isolate and identify thermophilic bacteria producing chitinase from hot spring located in Kanchanaburi Province and to evaluate the efficacy of bacterial isolates in inhibiting the growth of phytopathogenic fungi. A total of eight samples were taken from two hot springs, Hin Dad and Lin Thin hot springs. The samples were cultured on chitin-degrading bacteria enrichment medium and Tryptic soy agar (TSA) medium amended with 1% colloidal chitin and incubated at 45°C. Only one thermophilic bacterium producing chitinase was isolated from sample No. 6 derived from Lin Thin hot spring. Identification based on 16S rRNA gene sequence revealed that the isolated thermophilic bacteria producing chitinase (C6 2.1) was *Bacillus thuringiensis* with 100% sequence identity. The isolate C6 2.1 had the greatest protein content of 161 mg/ml after three days of incubation. In addition, the efficacy of C6 2.1 in inhibiting the growth of *Fusarium* sp. and *Colletotrichum* sp. using dual culture method was found to be limited.

Keywords: thermophilic bacteria, chitinase, hot spring, phytopathogenic fungi.

Stress tolerance during ethanol fermentation in mutants derived from *Kluyveromyces marxianus* DMKU 3-1042

Suphannee Richwarasin*
Kasetsart University, Bangkok, Thailand Suphannee.pa@ku.th

Noppon Lertwattanasakul
Kasetsart University, Bangkok, Thailand fscinple@ku.ac.th

The current situation of rising fuel prices around the world and the success of the invention of the COVID-19 vaccine led to an economic recovery and increased demand for transportation fuels. As a result, the demand for ethanol is higher in the mixture of gasohol. The ethanol industry as a renewable energy source can be produced from agricultural crops and microbial fermentation processes. Yeasts have the potential to efficiently convert sugar into ethanol. It grows fast, yields large quantities of ethanol and has a low cost. This study aims to study stress tolerance during ethanol fermentation of the yeast mutants. The *kan*MX gene fragments were transformed and randomly integrated into the chromosome of the yeast *K. marxianus* DMKU 3-1042. To study the ethanol tolerance, mutants were tested by culture on YPD medium supplemented with various concentrations of ethanol compared with the wild type. Of 28 mutants, 6 mutants (HAS 15, HAS 22, HAS 38, HAS 52, HAS 90 and HAS 91) and 3 mutants (HAS 16, HAS 23 and HAS 24), were found to be more resistant and more sensitive to high concentrations of ethanol, respectively, in comparison with the wild type. Other stresses during ethanol fermentation including osmotic pressure and high temperature were also tested. Two mutants (HAS 32 and HAS 38) and 6 mutants (HAS 18, HAS 19, HAS 21, HAS 33, HAS 52 and HAS 90) were more resistant and more sensitive to high osmotic pressure than that of the wild type strains. Twelve mutants (HAS 16, HAS 18, HAS 23, HAS 24, HAS 33, HAS 34, HAS 36, HAS 37, HAS 39, HAS 40, HAS 41 and HAS 42) were more sensitive to high temperature (40 °C). However, all interesting mutants should be further identified the insertion site of the *kan*MX gene, especially the HAS 38 strain that is resistant to various stresses including ethanol, high osmotic pressure and high temperature.

Keywords: *Kluyveromyces marxianus* DMKU 3-1042, Ethanol tolerance, osmotic pressure tolerance, high temperature tolerance

Fungal Phytopathogens from Durian Orchard in Chanthaburi Province and How to Control Them

Ananya Sahathippayakul
Department of Microbiology, Faculty of Science,
Kasetsart University, Bangkok, Thailand ananya.sah@ku.th

Piyangkun Lueangjaroenkit*
Department of Microbiology, Faculty of Science, Kasetsart University fscipkl@ku.ac.th

Durian is one of the most economically important fruit crops in Thailand. Most diseases in durian that damage agricultural products are caused by fungi. Previews research has reported the presence of chemicals that farmers commonly use in agricultural products. In this study, we isolated and identified fungi from samples of disease-infected durians from durian orchards in Chanthaburi Province. We obtained 15 isolated of plant pathogenic fungi. From molecular Identification, found 3 genera of fungi. Most of them were *Phomopsis* as 42.86%, followed by *Colletotrichum* and *Fusarium* were 35.71% and 21.43%, respectively four species of *Colletotrichum* have been found, one of them possibly as a new species. We selected interesting fungi to test the efficiency of ZnO nanoparticles, which have a low toxin, at 1, 2.5, and 5 mL/L. We found that ZnO nanoparticles had a good efficiency against phytopathogens in durian, the efficiency was increased with increasing concentration of ZnO nanoparticles. In vivo, at 5 mL/L, ZnO nanoparticles have the ability to decrease the incidence of disease from *Colletotrichum* sp. DL2-1 58.83% and *Colletotrichum gloeosporioides* DL6-1 81.12%. The results show to be another alternative for agriculturists to control the fungal cause of disease. The study of fungal phytopathogen distribution can be help to manage the disease control and to develop resistant plants against these phytopathogens.

Keywords: Durian, Fungal phytopathogens, ZnO nanoparticles, Antifungal activity

Investigation of preservation conditions of *Komagataeibacter oboediens* RC37-23 for commercial applications

Budsakorn Pengfung*
Kasetsart University, Bangkok, Thailand busakorn.pe@ku.th

Uraiwan Tippayasak Kasetsart University uraiwanmasud@yahoo.com

Gunjana Theeragool Kasetsart University fscignt@ku.ac.th

*Komagataeibacte*r is an acetic acid bacterium used in vinegar industry and bacterial cellulose production. From previous report, thermotolerant acetic acid bacterium, *K. oboediens* MSKU 3 isolated from banana was selected for further studied on adaption to high ethanol concentration followed by no ethanol supplemented condition under static cultivation at 37°C. The adapted strain, *K. oboediens* R37-9, which produced superfine bacterial cellulose with potential to be a raw material for biofilm production was selected. *K. oboediens* R37-9 was further improved by low-nutrient adaptation in coconut water medium to reduce the production cost of bacterial cellulose. *K. oboediens* RC37-23 was isolated from static culture of *K. oboediens* R37-9 in coconut water medium at 37°C. However, commercial utilization of *K. oboediens* RC 37-23 required appropriate preservation technique to avoid microbial contamination and changes in characteristics or cell death. The objective of this study was to investigate the effect of bacterial cellulose on cell survival rates and stability of microbial characteristics. Bacterial cells were preserved by freeze-drying method using 10 % skimmed milk and 1 % monosodium glutamate as cryoprotectant. Cell cultures were freeze at -80 °C for 24 hours and dried by freeze dryer. The freeze-dried sample was kept at -80 °C for 1 month. The survival rates of cells grown in the medium with and without cellulase after freezing were 98.48 and 88.51 %, respectively. The survival rates of cells grown in the medium with and without cellulase after freeze drying were 74.76 and 73.70 %, respectively. The survival rates of cells grown in the medium containing cellulase after freeze drying and kept at -80 °C for 1 month was 68.80 %. Acetic acid and bacterial cellulose production by cell cultures grown in the medium with and without cellulase supplementation from before freezing, after freezing and after freeze drying were similar and no variation of the RAPD-PCR profiles of cell cultures from all preservation steps were observed.

Keywords: *K. oboediens* RC37-23, freeze drying, survival rate, cellulase, acetic acid, bacterial cellulose, RAPD-PCR

Solid stage like-enrichment isolation of fungi involving styrene biodegradation

Chanokkorn choodokput
Department of Microbiology, Faculty of Science,
Kasetsart University, Bangkok, Thailand Chanokkorn.c@ku.th

Piyangkun Lueangjaroenkit*
Department of Microbiology, Faculty of Science, Kasetsart University fscipkl@ku.ac.th

In this research, solid-stage like-enrichment was performed. The fungi were identified from 3 sources: mangrove sediment soil, cattail soil, and garage soil. Twenty five isolates were obtained by solid stage like-enrichment. Seventeen genera were identified including *Cladosporium* 4 isolates, representing 16%, *Toxicocladosporium* 3 isolates, representing 18%, *Fomitopsis* 3 isolates, representing 18%, *Zasmidium* 2 isolates, representing 12%, *Diaporthe, Fusarium, Xylaria, Roussoella, Phaeosphaeriopsis, Trichomerium, Engyodintium, Chondrostereum, Lasiodiplodia, Sistotremastrum, Mucor, Trichaptum, Acremonium,* one isolate of each genus was found.

All of the fungi were found capable of digesting aromatic compounds. The RBBR dye experiment was used as a model. The fungi that were most effective in aromatic compounds degradation were *Trichomerium siamensis* P11 and *Xylaria feejeensis* P10. Fungi from mangrove soils were most effective in aromatic compounds degradation.

Keywords : Solid stage like-enrichment, Fungi, Bioremediation

Study of Bioactive Compound Accumulation in Dayflower Using UV-C Elicitation

Suttatinee Srechum*
Kasetsart University, Bangkok, Thailand suttatinee.s@ku.th

Wannarat Phonphoem Kasetsart University fsciwrp@ku.ac.th

Dayflower (*Commelina communis* L.) is one of the herbs that spread worldwide. This plant has been traditionally used in Japanese folk medicine. A previous study demonstrated that *C. communis* contains several bioactive compounds, including 1-deoxynojirimycin (DNJ), considered a potent α-glucosidase inhibitor. Thus, this study aimed to investigate the effect of UV-C on the bioactive compound accumulation in the dayflower plants grown in a greenhouse system. Different parts of the plants were initially harvested to determine the bioactive compound content. Then, the plants were exposed to UV-C light (wavelength = 280 nm) under three different conditions, including (1) 15 min UV-C exposure for 1 day, (2) 10 min UV-C exposure for 2 days, followed by 5 min for another 2 days, and (3) 1 min UV-C exposure for 7 days before being harvested and used for bioactive compound extraction and quantification. The results showed no significant difference in total phenolic, flavonoid, and alkaloid contents between control and UV-C-treated plants from all three conditions. The antioxidant activity of crude extracts was also measured using *in vitro* DPPH assay. The results showed that the percentages of DPPH inhibition in the leaf and stem were 30.45% and 69.48%, respectively, indicating a strong antioxidant capacity. Nevertheless, further studies are required to efficiently enhance bioactive compounds in *C. communis.*

Keywords: Dayflower, UV-C, Bioactive compounds, Antioxidant.

Study of antidiabetic and antioxidant properties of *Acacia pennata (L.) Willd.*

Apirada Onchot*
Kasetsart University, Bangkok, Thailand Apirada.o@ku.ac.th

Suttida Chukiatsiri Kasetsart University fscistd@ku.ac.th

The objective of this research is study the effect of *Acacia pennata (L.) Willd* on diabetes by inhibition of alpha-glucosidase alpha-amylase and resistance to free radicals extracted with various solvent, including distilled water, ethanol, and hexane. The experiment were determined by half-maximal inhibitory concentration (IC50). The antidiabetic assays showed that *Acacia pennata (L.) Willd* extract had biological activity of alpha-glucosidase and alpha-amylase. It was found that distilled water extracted had the greatest inhibition of alpha-glucosidase activity (IC50 = 273.28 ± 2.53 µg/ml) and alpha-amylase activity (IC50 = 452.82 ± 5.85 µg/ml). Moreover, previous studies have also found that *Acacia pennata (L.) Willd* extracts are effective in eliminating free radicals 2,2-diphenyl-1-picrythyhydrazyl radical (DPPH) and iron-binding properties. This study showed that ethanol extracted had the greatest inhibition of DPPH free radicals (IC50 = 194.24 ± 30.03 µg/ml) and the greatest iron binding properties (IC50 = 327.23 ± 4.62 µg/ml). Therefore, our results suggest that *Acacia pennata (L.) Willd* extract had the inhibitory effect on the activity of alpha-glucosidase, alpha-amylase, and the antioxidant activities. This may be useful for future studies on diabetes treatment and free radical scavenging.

Keywords: Anti-diabetes; Antioxidant; *Acacia pennata (L.) Willd.*

The efficacy of formalin-killed cell vaccine from *Aeromonas hydrophila* and *Aeromonas veronii* using a Halloysite nanotubes delivery system for the inhibition of disease occurring in Black and Red Tilapia

Kitsanai Wongsuwan*
Kasetsart University, Bangkok, Thailand kitsanai.w@ku.th

Assoc. Prof. Sasimanas unajak Kasetsart University fscissmn@ku.ac.th

Halloysite nanotubes (HNTs), natural clay, is able to alternate their surface properties through chemical modification. A variety of surface modified HNTs allow these materials to fix/ embed/ entrap with diverse biomolecules. Previous report demonstrated the properties of HNTs as biological compatibility, non-toxicity to living organisms and environment, and the efficient of fish vaccine delivery. Therefore, the effectiveness of surface modified HNTs in vaccine fixation was aimed to validate in different aspects. Since, the aeromonad disease has long lasting affect to Thailand's tilapia cultivation, therefore, the inactivated vaccine for controlling tilapia *Aeromonas* disease is the target vaccine in this study. In order to generate fish oral vaccine, four types of surfaces modified HNTs including non-modified HNT (H), APTES modified (3-aminopropyltriethoxysilane - HA), chitosan modified (HC), and chitosan–APTES modified (HAC) was fixed with the inactivated vaccine Thus, this inactivated vaccine was prepared as formalin killed cells (FKC vaccine) by preparing from *Aeromonas hydrophila* and *A. veronii*. Briefly, the bacteria in liquid medium was inactivated by 1% formalin overnight. The cells were later fixed with 10 $mg.mL^{-1}$ and 20 $mg.mL^{-1}$ HNTs (H, HA, HAC, and HC). The efficiency of fixed vaccines was evaluated on SDS-PAGE revealed similar fixing efficiency. Therefore, HNTs (10 $mg.mL^{-1}$) fixed with FKC vaccine (HF, HAF, HACF, and HCF) were used for releasing assay. The efficiency of vaccine released was monitored in the condition of pH 2, pH 6, and pH 8 for 7 hours with 1 hour interval. From SDS-PAGE analysis and Image-J analysis, the releasing of protein vaccine from delivery system were 1) average releasing of 13.5% from all types were observed in pH2 and average releasing of 11.5% from all types were observed in pH6-8, 2) HF showed 8% vaccine releasing at pH8, and 3) HACF and HCF showed continuous vaccine releasing along 7 hours whereas HF and HCF had maximum vaccine released at 1.5 hour and decreased thereafter. Taken together, these results demonstrated the efficiency of vaccine fixation and suitable vaccine releasing was observed in all types. The use of fish oral vaccine delivery system would prevent or reduce the emergence of infectious disease in economic fish species thereafter.

Keywords: Halloysite nanotubes, Tilapia, *Aeromonas,* formalin-killed cell vaccine.

Comparing of peptide derived from extracellular matrix for bone tissue

Pannaporn Tarkunjaroonkit
Kasetsart University, Bangkok, Thailand pannaporn.tr@ku.th

Bone tissue engineering was developed for the efficacy of bone replacement materials in orthopedic graft surgery. by choosing a variety of materials in this study, the objective was to compare A peptide that promotes adhesion from MC3T3-E1 cells and examines cell adhesion to the material. Chitosan used to immobilize peptides on a well plate. and experiments were performed in MC3T3-E1 cells cultured for 24 h in chitosan-coated well plates conjugated with each peptide containing RGD TEN-1 RGD+TEN-1 and then observed cell adhesion. Unconjugated chitosan well with peptides by actin filament staining method. The results showed that chitosan well conjugated with peptides exhibited greater cell adhesion using the ImageJ program compared to unconjugated with peptide.

Keywords: MB-chitosan , MC3T36-E1 , Peptide conjugation , Cell adhesion

The reversion of endothelial dysfunction by mushroom extract.

Jirawadee Kanglan
Kasetsart University, Bangkok, Thailand jirawadee.kan@ku.th

Cardiovascular disease is a group of diseases that have abnormalities of the heart and blood vessels. It is one of the leading causes of death worldwide. The main cause of cardiovascular disease is inflammation and endothelial dysfunction. At present, statin drugs have been prescribed to reduce plasma cholesterol and reduce the incidence of cardiovascular disease. They also have a positive effect on the function of endothelial cells. However, statin drugs have side effects of muscle weakness. This study, thus, aimed to investigate the effects of wild mushroom extracts on the reversion and prevention of endothelial dysfunction. Cell culture techniques were practiced using HepG2 liver cancer cells treated with Hawthorn and KS extract at concentrations between of 0.5 to 500 µg/mL. It was found that such range of concentration of the extract did not affect cell growth, compared to the control. Then human coronary artery cell (HCAEC) was used to optimize cell density for nitric oxide (NO) production by measuring the concentration of nitrite (NO_2) dissolved in the cell culture medium at various culturing time. The results showed that nitrite levels were detectable when the cell reached 80% confluency. Additionally, total proteins were extracted from HCAEC cells and measured concentration using the BCA Protein Assay Kit. It was found that cells cultured in one well of 6-well plate contained 168.4 ± 8.32 µg of protein. That is sufficient for the subsequently determination of endothelial dysfunction marker (BH4) by High Performance Liquid Chromatography (HPLC), in order to summarize the optimal conditions for studying the effects of wild mushroom extracts in reversing and preventing endothelial dysfunction.

Keywords: Endothelial dysfunction, Mushroom, Statin, Cardiovascular disease, eNOS

Development of a lateral flow immunoassay for seafood allergy

Chomchanok Aimnoi
Kasetsart University, Bangkok, Thailand Chomchanok.a@ku.th

Seafood is rich in minerals and has lower fat content than other meat proteins. It's very popular, but many people are allergic to seafood. Seafood allergies are caused by abnormal reactions in the immune system of consumers. The main allergens in seafood are tropomyosin a protein in muscle that is responsible for controlling muscle contraction and relaxation. Although seafood allergies are common, medications can still be obtained. An examination must be conducted in a hospital. The hospital's examination techniques include skin allergy testing and specific IgE blood testing, both of which are very expensive and require a long time to detect. However, if testing can be developed using a lateral flow test, it will reduce inspection costs and time. The purpose of this study is to extract allergen proteins from shrimp, purify tropomyosin, and develop a self-test kit. Protein from white shrimp was extracted and purified by precipitation at isoelectric pH and 30-50% ammonium sulfate, respectively. Before spraying the obtained protein sample onto the membrane, the presence of the protein was tested with tropomyosin-specific antibodies. Antibodies attached to gold nanoparticles can flow onto the membrane and form purple stripes from the gold nanoparticles. The pH for the most efficient flow of protein to the membrane is pH 9. The color bands appearing on the membrane are can be seen with the naked eye. From experiments, was found that tropomyosin can only be partially purified. However, the protein content of tropomyosin is still sufficient to bind to tropomyosin-specific antibodies and display on the membrane. The color of the gold nanoparticles indicates the location of the protein.

Keywords: Allergen, Tropomyosin, Lateral Flow Immunoassay (LFA)

The study of biological activities of Marigold crude extract

Suprarada Hirunanusorn*
Kasetsart University, Bangkok, Thailand, suprarada.h@ku.th

Pichamon Kiatwuthinon, Kasetsart University, fscipmk@ku.ac.th

Marigold (*Tagetes erecta* L) consists of various chemical compounds, such as phenolics, flavonoid, quercetins. These compounds have various pharmacological effects such as antioxidants anti-cancer anti-inflammatory. Marigold is currently consumed in various ways. This study aims to determine phenolic and flavonoid compounds and to study the biological activities of Marigold crude extract that was extracted by 68% v/v ethanol and dried Marigold crude extract coated with maltodextrin. First, total phenolic compounds in three independent extractions were 23.21 ± 0.92, 30.74 ± 1.43, 39.66 ± 2.00 µg GEA/µl extract respectively. Next, the total flavonoid compounds were 10.27 ± 0.18, 29.09 ± 0.75, 37.38 ± 0.42 µg QCE/µl extract, respectively. For dried marigold flower extract coated with maltodextrin, the total phenolic content was 10.47 ± 1.12 µg GEA/µl extract. Total flavonoid content was 19.57± 1.14 µg QCE/µl extract, Then, anti-protein denaturation assay was studied. The results showed that the marigold flower extract extracted with 68% ethanol significantly exhibited higher efficiency in anti-denaturation than dried marigold flower extract coated with maltodextrin. Furthermore, the DNA damage antioxidants activity was investigated. The marigold flower extract extracted with 68% ethanol showed an antioxidant activity with significant difference among three independent extractions. Altogether, it can be concluded that the study of biological activities of Marigold crude extract can be useful for a wide variety of applications in the future.

Keywords: Antioxidants, Anti-inflammatory, Phenolic, Flavonoid, Marigold.

In silico discovery and *in vitro* activity of peptide inhibitors against SARS-CoV-2 main protease

Nutnaree Kumsiri*
Kasetsart University, Bangkok, Thailand nutnaree.ku@ku.th

Kiattawee Choowongkomon Kasetsart University kiattawee.c@ku.th

The SARS-CoV-2 virus's main protease (M^{pro}) is an enzyme involved in viral replication that permits the virus to replicate in the host and causes COVID-19 disease in humans. Hence, the SARS-CoV-2 virus's main protease is a significant target enzyme's inhibitor discovery. This research purpose to examine the binding by docking the enzyme's binding site with tripeptides, The intermolecular interactions at binding sites, and pharmacophores related to tripeptide action was assayed. Aim tested 8,000 tripeptides the best top 5 were Ile-Arg-Arg (IRR), Tyr-Arg-Val (YRV), Gln-Arg-Arg (QRR), Arg-Arg-Asp (RRD), and Arg-Arg-Arg (RRR), respectively. The major tripeptides interaction was non-covalently interaction at the enzyme binding site, and the pharmacophore functioned as either hydrophobic or a hydrogen bond donor or acceptor. By adding 0.4 mM IPTG (Isopropyl-D-1-thiogalactopyranoside) and incubating at 16 °C, SARS-CoV-2 recombinant protease was expressed in vitro. Ni-NTA column affinity chromatography and gel electrophoresis (SDS-PAGE) were employed to purify and to determine the molecular weight of the SARS-CoV-2 recombinant protease. An Approximate purified protein revealed a molecular weight of 35 kDa. The optimal conditions for enzyme activity was pH 7.2, 30 °C, and 800 nM protease, were used to analyze the kinetic values, Using the FRET-base protease assay, the maximal velocity (V_{max}) was 486.2 RFU/min, and the substrate affinity (K_m) was 20.40 µm. Tripeptides Tyr-Arg-Val (YRV) and Arg-Arg-Asp (RRD) show relative the best inhibitory percentages which exhibited greater than 50% inhibition. The tripeptide Tyr-Arg-Val (YRV) displays the most protease-inhibitory properties, with an IC_{50} value of 18.985 ± 4.93 µM.

Keywords: Docking, Tripeptide, SARS-CoV-2 main protease, COVID-19 disease

Comparison of protein expression and localization of Por1p and Cfu1p in Δ*snf1::ADE1* and wild-type strains of *Yarrowia lipolytica*

Siroj Rerkprajak*
Kasetsart University, Bangkok, Thailand siroj.r@ku.th

Dr.Napapol Poopanitpan Kasetsart University, Bangkok, Thailand fscinpp@ku.ac.th

Bioremediation by microbial is another important alternative for eliminating oil contamination in water sources. *Yarrowia lipolytica* is a yeast capable of degrading alkanes, fatty acids, and oils. And that makes scientists interested in studying this yeast for use in bioremediation. However, the regulation of the metabolism of hydrophobic substrate has not been completely understood in this yeast. From previous studies, they found that Por1p and Cfu1p proteins are involved in the regulation of expression of various genes in beta-oxidation. Moreover, the deletion of the *SNF1* gene in this yeast leaded to the loss of ability to growth on alkane-containing medium as a sole carbon source. Therefore, this study focused on in the effect of *SNF1* gene disruption on the expression and localization of Por1p and Cfu1p. Each plasmid (pPOR1-EGFP and pCFU1-EGFP) was introduced into wild type and Δ*snf1::ADE1* strains by electroporation. After that the transformants was analyzed for growth in different sole carbon source media. These results suggested that the increase of the gene copies of *POR1* and *CFU1* was not clearly affected the growth of the four yeast strains. Next, western blot technique was used to compare the expression of both proteins, but the Por1p and Cfu1p were not detected. Thus, the expression level of both proteins could not compare. Finally, the localization of Por1p-EGFP into each yeast strain was analyzed by fluorescence microscopy. It was found that most cells of both strain were found to be located within the nucleus, irrespective of carbon sources. It can be initially pointed out that the knockout of *SNF1*gene did not effect on the location of the Por1p protein. Interestingly, the Por1p-EGFP was also found outside the nucleus in several cells. However, the precise location of which organelle is still not clear, so further studies are needed in the future.

Keyword: Alkane and Oil degradation, Yeast model for Bioremediation, *Yarrow lipolytica*

Anti-Inflammatory Effects of *Cratoxylum formosum* Extract

Yanisa Choominthong*
Kasetsart University, Bangkok, Thailand Yanisa.cho@ku.th

Tuangtong Vongpipatana Kasetsart University tuangtong.v@ku.th

Cratoxylum formosum (CF), called Tiw or Taew in Thai, is a Southeast Asia native plant which fresh leaves are usually consumed as side dishes with local food. CF bark, leaves and roots have been used in traditional medicine for relieving fever, stomach ache, diarrhea, food poisoning and internal bleeding. It has been reported that the aqueous extract of CF leaves contains flavonoids and phenolic compounds which have anti-oxidative and anti-bacterial activities. In addition, CF leaf extract exhibited cytotoxicity against many types of cancer such as breast, liver, cervix and colon. However, the anti-inflammatory effect of CF leaf extract is still unknown. Thus, the aim of this study is to investigate an anti-inflammatory effect of CF leaf extract. First, the CF extract was prepared from dry leaves and boiled with water. To study an anti-protein denaturation activity of CF extract *in vitro*, bovine serum albumin (BSA) was mixed with CF extract and boiled at 85˚C. The results showed that dry CF leaf extract at a concentration of 0.5-1 µg/ml significantly inhibited BSA denaturation. Then, the effects of CF extract on inhibition of nitric oxide (NO) production in inflammatory macrophages were examined. Here, RAW 264.7 macrophages were activated by lipopolysaccharide (LPS) to become inflammatory macrophages. The production of NO significantly reduced in LPS-activated macrophages treated with dry CF leaf extract at concentration between 7.78-250 µg/ml in a dose-dependent manner. All of these results indicated that dry CF leaf extract has a high possibility to have anti-inflammatory effect which can be useful for inflammatory treatment in the future.

Keywords: *Cratoxylum formosum* (CF), inflammation, macrophages

Analysis of lipid accumulation in modified yeast.

Ratinuch Charoensuk
Kasetsart University, Bangkok, Thailand ratinuch.c@ku.th

Napapol Poopanitpan
Kasetsart University fscinnp@ku.ac.th

Currently, the study of biofuel production from single-celled organisms is gaining popularity as a substitute for plant-based oil. *Yarrowia lipolytica* is one of the target organisms that has been studied for its potential as an Oleaginous microorganism. Previous studies have found that the protein group SNF1/AMPK is associated with the accumulation of oil in this type of microorganism. Deletion of the SNF1 gene can increase the ability to accumulate oil, but it has a negative impact on growth compared to the original strain. Therefore, this research aims to create a strain that can accumulate more oil while eliminating the negative impact on growth. The ESL strain was created in the laboratory, and the study aims to investigate the growth and oil accumulation characteristics in this strain. After four days of observation, it was found that the ESL strain grew well in various carbon sources, similar to the original strain. Next, the study will analyze the oil accumulation in the strain, which is currently in the suitable condition for measuring oil content using Nile Red staining and fluorescence measurement.

Keyword: Oleaginous microorganism, *Yarrowia lipolytica*, fluorescence measurement

Development of Heart Failure Test Kit

Chonlada Phraibueng
Kasetsart University, Bangkok, Thailand Chonlada.phr@ku.th

Heart failure occurs when the heart muscle doesn't pump blood as well as it should. As a result, the body is deprived of oxygen and nutrients and ultimately developed life threatening condition. Therefore, the N-terminal proB-type natriuretic peptide (NT-proBNP) has been used as a heart failure biomarker. Currently, Thailand imports diagnostic kits which use antibodies specific to NT-proBNP and are quite expensive. The aim of this study was to produce a rapid diagnostic kit for heart failure in canine and feline. For this purpose, the gene encoding a single-chain fragment variable (scFv) that binds specifically to NT-proBNP was cloned into an expression vector (pMOD) then transferred into the bacterium HB2151. The optimal conditions for D4 scFv protein expression were observed at 30 °C and a final IPTG concentration at 0.5 mM for 6 hours. The protein was then extracted by ultrasonication and purified by Ni^{2+} affinity chromatography. D4 scFv was eluted from the column using an 10% elution buffer (20 mM Tris-HCl pH 8.0, 300 mM NaCl, 59 mM Imidazole). The ELISA result showed that D4 scFv bound the C-terminal of canine NT-proBNP stronger than human serum albumin (HSA). However, the repeat of ELISA experiments is required before the conclusion of affinity can be made.

Keywords: NT-proBNP, Heart failure, Single-chain fragment variable (scFv)

Investigation of amino acids important to quinone oxidoreductase activity by site-directed mutagenesis

Nattanicha Kadhan
Kasetsart University, Bangkok, Thailand nattanicha.kad@ku.th

Dr. Panu Pimviriyakul Kasetsart University panu.p@ku.th

Quinone oxidoreductase is an intracellular cytosolic enzyme that catalyzes the degradation of quinones. It is an important oxidoreductase enzyme found in both prokaryotes and eukaryotes. acts to eliminate free radicals within the cells which is responsible for reducing quinone into hydroquinone compounds. In this experiment, the effects of glutamine and threonine on quinone oxidoreductase activity were investigated enzymatic engineering was proceed to enhance the quinone oxidoreductase enzyme activity through amino acid mutagenesis. Five amino acids Q128N, Q128L, T131S, T131V, and T131S were targeted to change site-directed mutagenesis. Only one QOR mutant plasmid ,T131V, was constructed and confirmed by nucleotide sequencing. Purified mutant was used for enzymatic assay. The k_{cat}/K_m of T131V showed greater activity than that of wild-type, indicating that the QOR mutant had stronger catalytic performance than WT-QOR for research on substrate selectivity. With regards to enzymes, it is clear that the T131V mutation alters the enzyme's activity, enhancing its catalytic efficacy.

Keywords: Quinone oxidoreductase (QOR), Site-directed mutagenesis, *Leishmania orientails*

Analysis and confirmation of new molecular targets for the inhibition of growth of melanoma cells and/or keloids with bioinformatics

Tanaporn Chureang*
Kasetsart University, Bangkok, Thailand Tanaporn.chur@ku.th

Pichamon Kiatwuthinon Kasetsart University fscipmk@ku.ac.th

Cancer is a disease involving a group of abnormal cells in which some of the body's cells grow uncontrollably. Skin cancer is generally classified into two major categories: melanoma and nonmelanoma skin cancers. Causes of skin cancer are genetics or exposure to carcinogenic substances such as ultraviolet rays. This leads to the mutation of DNA which generate genetic defects and an abnormal cell division. The purpose of this study was to identify differentially expressed genes (DEGs) in squamous cell melanoma tissue samples compared to normal keratinocyte skin tissues using Galaxy which is an online bioinformatic tool and to investigate the functions of DEGs using DAVID. The results showed that there is a total of 346 DEGs with 173 upregulated and 173 downregulated genes under 1.6-fold change cutoff and $p<0.05$. Based on DAVID pathway analysis, one of the significantly upregulated cellular pathways is cell cycle including genes such as cyclin B1 (CCNB1), cyclin B2 (CCNB2), and the minichromosome maintenance complex component 2 (MCM2). RT-qPCR was employed to validate these three gene expressions in A431 skin cancer compared with HaCaT non-cancer cell line. Interestingly, the results revealed 2.23, 3.34, and 10-fold decreases in the expression of the CCNB1, CCNB2, and MCM2, respectively. In summary, a bioinformatic analysis revealed that a total of 346 DEGs was identified in squamous cell melanoma cells which are responsible for different biological pathways. However, contradict results were obtained from the qRT-PCR validation. Thus, further investigation is required before identifying the new gene markers for skin cancer.

Keyword: Skin cancer, Melanoma, Galaxy, RNA sequencing, qRT-PCR.

Study of Biological Activities of Mulberry Root Extracts for Potential Cosmeceutical Applications

Pariyakorn Prawatklang*
Kasetsart University, Bangkok, Thailand pariyakorn.pra@ku.th

Wannarat Phonphoem Kasetsart University fsciwrp@ku.ac.th

Mulberry (*Morus* spp.), which belongs to the Moraceae family, is an herbal medicinal plant originating from East Asia. This plant is widely grown primarily in the north and northeast of Thailand and has been used in Thai traditional medical and health products. Previous studies reported that different parts of mulberry contain several bioactive compounds, such as phenolics, flavonoids, and alkaloids. These substances are also associated with antioxidants, anti-cancer, anti-inflammation, and anti-bacterial activities. Therefore, this research aimed to investigate the bioactive compound content and some biological properties of mulberry root extracts. First, the extraction solvent was optimized, and the result showed that a 40 percent concentration of ethyl alcohol was the most effective solvent. After that, the bioactive compound content in three mulberry cultivars, namely Buriram 60, Kamphaeng Saen 42, and Maelook-on, was determined. The highest amount of total phenolic and flavonoid compounds was obtained in Kamphaeng Saen 42, followed by Buriram 60, and Maelook-on, respectively. Then, DPPH, FRAP, and ABTS tests were used to determine the antioxidant activity of mulberry roots. The results indicated that Kamphaeng Saen 42 had the best antioxidant activity, of which the DPPH free radical-scavenging capacity reached 72.00 ± 1.53%, and also showed the highest values for both FRAP and ABTS assays. In addition, the effect of the mulberry root extracts against *Staphylococcus aureus* was examined by the agar disc diffusion method. The preliminary result indicated that no inhibition zone was observed when using the mulberry root extracts at concentrations of 5, 10, 15, and 20 mg/mL. In conclusion, this study demonstrated that different cultivars of mulberry roots were rich in bioactive compounds with significant variations in their levels that have potential utilization in industries.

Keywords: Mulberry roots, Phenolic compounds, Flavonoids, Antioxidants and Anti-bacterial activity.

Anticancer activities against human skin cancer cell lines from root and stem of *Grammatophyllum Speciosum* Blume extracts.

Proudphat Jumnongjit*
Kasetsart University, Bangkok, Thailand proudphat.j@ku.th

Nattanan T-Thienprasert Kasetsart University fscinnp@ku.ac.th

Melanoma and non-melanoma skin cancers are the most common skin cancer among Caucasians and their incidence is increasing every year. Ultraviolet radiation from sunlight has been identified as one of the risk factors for the disease. Currently, available treatments include chemotherapy, radiation and surgery. However, these treatments are associated with many health side effects such as hair loss (alopecia), vomiting and immunodeficiency. The aim of this study was to investigate the anticancer activities of root and stems from *Grammatophyllum Speciosum* Blume extracts against human skin cancer cell lines using MTT assay. In this study, *G.speciosum* was cultured and exposed under white, red and blue LED lights for a variety of times (Day 0, Day 3 and Day 7) . Preliminary data showed that 100 g/mL extracts from the root and stem of *G.speciosum* that had been exposed to white, red and blue LED lights for a variety of times (Day 0, Day 3, and Day 7) had a stronger inhibitory effect on melanoma carcinoma cells than non-melanoma cancer cells (A431). As contrast to HaCaT cells, it showed week inhibition. By examining the LED treatment time point, it was found that the anticancer activity increased after the treatment.

Keywords: *Grammatophyllum Speciosum* Blume, Skin cancers, Anticancer activity.

Enhancement of phytochemicals in orchid by abiotic stresses

Pimsiri Yimlamai*
Kasetsart University, Bangkok, Thailand, pimsiri.y@ku.th

Attawan Aramrak, Kasetsart University, fsciawa@ku.ac.th

Orchids are economically and popularly plants in Thailand due to the characteristics and beautiful colors of the flowers. *Dendrobium* contain important compounds such as phenolics and anthocyanins. Orchids also have biological activities, such as anti-oxidant and anti-cancer. In addition, abiotic stresses, such as heat, drought, and salinity, can affect plant growth and its production and accumulation of bioactive compounds in the plants. In this research, we studied the effect of abiotic stresses on the production of bioactive compounds and anti-oxidant activity of *Dendrobium* Topaz Dream × *Dendrobium bigibbum* (Dt × Db). In the tissue culture, three stress conditions; (1) Chitosan, (2) PEG6000, and (3) Sodium chloride at different concentrations were applied to plants for 3 months. The content of phenolics and flavonoids and free radical scavenging activity were investigated. It was found that a medium containing chitosan at a concentration of 40 ppm was able to promote the plant growth by giving the greatest sum of fresh weight 1,523.05 mg. Crude extract from plants cultured in the medium containing PEG6000 at a concentration of 30 g/L gave the highest amount of total phenolics and total flavonoids of 3.70 and 1.71 µg of GAE / g of tissue respectively. The results from the antioxidant activity showed that when plant obtained sodium chloride starting at a concentration of 50 mM, the crude extract can inhibit the free radicals at approximately 22.24 %.

Keywords: PEG6000, Chitosan, Sodium chloride, Phenolic compounds, Flavonoid compounds

Antibacterial activity of *Grammatophyllum speciosum* extract

Pascha Nateerom
Kasetsart University, Bangkok, Thailand pascha.n@ku.th

The overuse of antibiotics is one of the causes of antibiotic resistance. It enables germs to evolve and developed antibiotic resistance. Therefore, new alternative antibacterial agents are urgently required. One of them is research into the various plant extracts' antimicrobial properties. This project was therefore aimed to investigate bacterial inhibitory potential of treated *Grammatophyllum speciosum* under different light emitting diode (LED) that extracted by water and ethanol Importantly, *G. speciosum* has reportedly been shown to possess significant qualities like an elixir, numerous painkillers, including their impact on anti-aging. However, there has not been a study on the antibacterial activity of *G. speciosum*. By performing agar disk diffusion assay, the results demonstrated that 100 µg/mL of water crude extract from root and stem of treated *G. speciosum* under different LED lights, had no inhibitory effects against growth of all tested bacteria (*Enterobacter aerogenes*, *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus epidermidis*, *Staphylococcus aureus*, and Methicillin-resistant *Staphylococcus aureus*). In addition, under various LED lights, 1,000 µg/mL of an ethanol crude extract from the treated *G. speciosum*'s root and stem showed relatively weak inhibition of the growth of all tested bacteria with clear zone diameters lesser than 14 mm. Thereby, higher concentrated crude extracts will be required, and future experiments may need to use a new extraction solvent.

Keywords: *Grammatophyllum speciosum*, Antibacterial activity, Bacteria, Antibiotic resistance

Development of Biological Product Delivery in Fish

Rugchart Pansuay*
Kasetsart University, Bangkok University, rugchart.p@ku.th

Sasimanas Unajak Kasetsart University fscissmn@ku.ac.th

Fish vaccination by injection is the most effective method to introduce vaccine to the fish and activate their immunities. This vaccination method requires skilled person for vaccination and fish farm labor which is time-consuming and costly. The additional cost would be faced when vaccine booster is required. Therefore, the alternated vaccination method to induce immune response such as immersion vaccine or oral vaccine is being interested and being used in aquaculture. This research, the preparation of nano – vaccine delivery system was performed aimed to fix and deliver the vaccine through oral vaccine method. Then, the chitosan – TPP/ alginate nanoparticle (CANp) was firstly prepared as dual cross-link. Chitosan polymer was synthesized by cross-link with tripolyphosphate polyanion (TPP). The second linker was added with alginate – SDS polymer. Preliminary determination on the capacity of CANp in loading with protein was tested with bovine serum albumin (BSA). The SDS-PAGE demonstrated the efficient loading of BSA with CANp. Then, the truncated-Sip vaccine, recombinant protein subunit vaccine for control streptococcosis disease in tilapia, was used as a target of this system. The vaccine was prepared by inducing the protein expression in Escherichia coli expression system followed with affinity protein purification. The purified protein with approximately 68 kDA was observed on SDS-PAGE. Thus, the test on capability of CANp in truncated-Sip vaccine was tested. Result demonstrated that the CANp could fixed all 1.96 mg truncated-Sip vaccine. Then, Testing the release of recombinant proteins from the delivery system by simulating the pH conditions in the gastrointestinal tract of fish, including stomach (pH 2), mouth and esophagus (pH 6), small intestine (pH 7.4) and bile (pH 7.5-8.0). Releasing of recombinant protein was observed at pH 6, 7.4, 8 and bile salt

Keywords: Truncated-Sip protein, *Nile Tilapia*, Chitosan-TPP/Alginate nanoparticles, Fish vaccination

Mutagenesis in AtBgl3A beta-glucosidase from *Acetivibrio thermocellus*

Warittha Yuencheep*
Kasetsart University, Bangkok, Thailand, warittha.y@ku.th

Prachumporn Kongsaeree, Kasetsart University, fscippt@ku.ac.th

Beta-glucosidase is an important enzyme involved in the degradation of cellulose into glucose by hydrolysis of the beta-1,4-glucosidic bonds. Glucose can be used as a starting material to produce bioethanol. Previous research found that the activity of beta-glucosidase AtBgl3A from *Acetivibrio thermocellus* (Accession number ABN52488.1) decreased at high temperatures. In this study, we generated the mutant *AtBgl3Amut* gene by random mutagenesis, and the recombinant plasmid pET28b-AtBgl3Amut was transformed into *Escherichia coli* BL21 (DE3) using electroporation method. However, it appeared that the *AtBgl3Amut* gene may have been over-mutated such that the resulting mutant enzymes lost the activities of beta-glucosidase. Next, we observed that AtBgl3A exists as a dimer. Each subunit has an extended C-terminus that blocks the active site of the other subunit. We were then interested in the role of this extended C-terminus. We then generated the *AtBgl3AΔCT* gene that lacks the coding sequence for the extended C-terminus, and the recombinant plasmid pET28b-AtBgl3AΔCT for the subsequent production of AtBgl3AΔCT with shortened C-terminus. After that the kinetic properties of AtBgl3AΔCT will be compared with those of the wild-type enzyme. However, the construction of the recombinant plasmid pET28b-AtBgl3AΔCT is still in progress. This project may lead to further improvement of the enzyme properties for biomass degradation, and future industrial applications.

Keywords: Glycoside Hydrolase family3, Random mutagenesis, AtBgl3A, *Acetivibrio thermocellus*

Study of anti-aging potential of *Hibiscus sabdariffa* L. extract

Sansiree Charoenphon*
Kasetsart University, Bangkok, Thailand sansiree.c@ku.th

Suttida Chukiatsiri, Kasetsart University, fscistd@ku.ac.th

Skin aging can be caused by both internal and external factors. These factors will result in damage skin's structure and physiology. The dermis layer is composed of collagen and elastin fibers which are components in connective tissues, that have been studied to be involved in skin aging. In addition, the ability to remove free radicals has been studied because oxidation products made by free radicals can cause skin aging. Previous research on *Hibiscus sabdariffa* L. extract found that the extracts contained Phenolic compounds, Anthocyanins and Flavonoids with antioxidant and antimicrobial activities. This research is interested in the study of anti-aging potential of *Hibiscus sabdariffa* L. extract. Extracts were extracted with 3 types of solvents: ultrapure water, ethanol, and hexane. Bioactivity was studied for the ability to inhibit enzyme activities that catalyze the breakdown of beauty compounds consisted of inhibition of collagenase and elastase activity. In addition, antioxidant activities were investigated consisted of scavenging of DPPH and iron-binding properties. The experiments were carried out in a microwell plate (96-well), and the results were analyzed by inhibitory concentrations (IC_{50}). The results showed that extracts from the *Hibiscus sabdariffa* L. extracted with ethanol had the great ability to inhibit the activity of collagenase and elastase with IC_{50} values of 436.23 ± 17.16 and 1,194.57 ± 2.52 µg/mL, respectively. Moreover, *Hibiscus sabdariffa* L. extracted with distilled water had the best DPPH scavenging ability with IC_{50} values of 1,055.61 ± 3.50 µg/mL and *Hibiscus sabdariffa* L. extracted with ethanol had the best iron-binding properties ability with IC_{50} values of 274.99 ± 9.08 µg/ml. Therefore, the extracts from the *Hibiscus sabdariffa* L. could inhibit activities of collagenase, elastase and had antioxidant ability *Hibiscus sabdariffa* L. extract could be applied to the development of beauty products of anti-skin aging.

Keywords: Anti-aging, Hibiscus sabdariffa L. extract, anti-collagenase, anti-elastase, antioxidant

Investigation of the role of Tyr134 and Arg268 in Quinone oxidoreductase from *Leishmania orientalis*

Sumita Harungsee
Kasetsart University, Bangkok, Thailand sumita.h@ku.th

Dr. Panu Pimviriyakul Kasetsart University panu.p@ku.th

Quinone oxidoreductase from the protozoan *Leishmania orientalis* that was found in Thailand belongs to the oxidoreductase family of enzymes. It is responsible for scavenging free radicals, which plays an important role in reducing intracellular oxidative stress. The enzyme catalyzes the reduction of quinone to hydroquinone by accepting two electrons from NAD(P)H. Based on the 3D structural model of the quinone oxidoreductase enzyme and considering the binding site of NADPH, it was found that the nicotinamide ring forms hydrogen bonds with several amino acid side chains, including Thr131, Tyr134, and Arg268. The purpose of this research was to study the potential role of amino acids in the catalysis of quinone oxidoreductase. Thus, the amino acid positions Tyr134 and Arg268 of the quinone oxidoreductase enzyme were altered by site-directed mutagenesis. The kinetic parameters which are V_{max}, K_m, k_{cat}, and k_{cat}/K_m values obtained from the enzyme kinetics study suggested that the purified mutant quinone oxidoreductase enzymes; Y134F, Y134H, R268K, and R268Q were specific to the substrate and had better catalytic performance than wild-type quinone oxidoreductase enzymes. The data suggest that Tyr134 and Arg268 are not important for the enzyme catalysis. The presence of these residues may suppress the catalytic activity of wild-type quinone oxidoreductase enzymes, which may require further study in the future.

Keywords: Quinone oxidoreductase (QOR), *Leishmania orientalis*, Site-directed mutagenesis, Enzyme kinetics

Production of peanut allergen as standardized protein

Nantiya Phophorm
Kasetsart University, Bangkok, Thailand nantiya.ph@ku.th

Assoc.Prof. Chotika Yokthongwattana Kasetsart University fscicks@ku.ac.th

This research used *E. coli* cells as the host to produce recombinant Ara h 2, the primary allergen protein in peanuts, which will be used as a standard substance in the examination of allergies using the standard examination set. Beginning with the intermediate design for the recombinant Ara h 2 protein. The recombinant Ara h 2 protein was expressed using the vector pET24a, the host *E. coli* cell strain BL21 (DE3), and the Rosetta strain. 1 mM IPTG was utilized to induce the expression of the Ara h 2 protein at 16, 30, and 37 °C for 3, 6, and 20 hours at each temperature. The proteins were then extracted with a 20 mM Tris-HCl solution with a pH of 6.8 and 1 mM PMSF. The expression of the Ara h 2 protein was analyzed utilizing SDS-PAGE and a Western blot with an Amersham ECL Western Blotting Detection Reagent kit. When the E. coli strain BL21 (DE3) was used as the host cells, recombinant protein expression was not observed. However, when the *E. coli* strain Rosetta was used as the host cells, the Ara h 2 protein was expressed under 1 mM IPTG conditions at 30 and 37 °C. Expression during pelleting and cracking, but not in the lysate, indicates the protein's insolubility. Plasmids pTF16 and pGro7, chaperone proteins, were used to help fold the protein into the correct structure and solubility. However, the inclusion of the pTF16 and pGro7 plasmids did not result in the expression of the recombinant Ara h 2 protein. Thus, it is possible to generate recombinant Ara h 2 at 1mM IPTG, 30 and 37 °C. The results of this study are expected to pave the way for additional research into the engineering of recombinant proteins.

Keywords: Ara h 2, Peanut allergen, Recombinant protein, *Escherichia coli*

Characterization of Glycoside Phosphorylase Activity of *At*Bgl3B from *Acetivibrio thermocellus*

Jantima Kumtae*
Kasetsart University, Bangkok, Thailand, jantima.ku@ku.th

Prachumporn Kongsaeree, Kasetsart University, fscippt@ku.ac.th

*At*Bgl3B from *Acetivibrio thermocellus* is an *N*-Acetyl-ß-D-glucosaminidase (NagZ, EC 3.2.1.52) that belongs to glycoside hydrolase family 3. Previous research has shown that several NagZ enzymes can catalyze the break down glycosidic bonds via 2 activities, which are the hydrolase activity that uses water in the hydrolysis reaction, and the glycoside phosphorylase (GP) activity that uses inorganic phosphate in the phosphorolytic reaction. This study aimed to investigate the GP activity of *At*Bgl3B. The recombinant plasmid pET28b-*At*Bgl3B was transferred to *Escherichia coli* strain BL21 CodonPlus (DE3)-RIPL. *At*Bgl3B was expressed from bacterial cultures and purified. The kinetic properties of the GP activity of *At*Bgl3B were studied with different substrates under varied phosphate concentrations, ranging from 0–200 mM, in order to determine the effect of phosphate on *At*Bgl3B activity. The kinetic analysis showed that the addition of the phosphate in the degradation of 4-nitrophenyl-*N*-acetyl-ß-D-glucopyranoside (*p*NP-GlcNAc) resulted in an increase in the k_{cat} values. The highest k_{cat} value was obtained when the phosphate concentration was 100 mM, which was 1.5 times higher than that in the phosphate-free condition. This indicated that *At*Bgl3B could exhibit both hydrolase and GP activities toward *p*NP-GlcNAc. However, when the phosphate concentration increased to 150 mM and 200 mM, the k_{cat} value decreased. Additionally, in degradation reactions against other substrates (aside from *p*NP-GlcNAc), the increasing phosphate concentration resulted in the reduction of the k_{cat} values. The results obtained in this study indicated that *At*Bgl3B specifically exhibited GP activity towards *p*NP-GlcNAc among the tested substrates.

Keywords: *Acetivibrio thermocellus*, Glycoside phosphorylase, N-Acetylglucosaminidase

Investigation of Culturing Conditions for Pigment Induction of Microalgae Under Environmental Stress

Thipakorn Ruengboonsuk
Kasetsart University, Bangkok, Thailand thipakorn.r@ku.th

Assoc.Prof. Chotika Yokthongwattana Kasetsart University fscicks@ku.ac.th

Many studies have been performed on the antioxidant activity of unicellular algae. *Chlamydomonas reinhardtii* can be used to create a wide range of pharmaceutical and cosmetic products. It has been discovered that the carotenoids, which are pigments present in this algae, account for its antioxidant activity. Plants contain many kinds of carotenoids, including β-carotene, lutein, and zeaxanthin. They are antioxidants, therefore algal cells under stress frequently produced them for protection. Algae can release more pigments if the culture process is performed effectively. For the potential for pigment creation and growth to be possible, a balance must exist. Therefore, this research aims to study the optimum conditions for culturing and stimulating algae to increase their pigment production by cultivating 2 algae strains, CC-125 and CC-4101 with *npq2* mutations in culture medium with various salt concentrations. To test the algal extract's antioxidant abilities, 100% ethanol was used in the extraction process. And using DMSO for the assay analysis of the extracts' ability to act as antioxidants using different methods, including DPPH radical scavenging activity and Ferric Ion Reducing Antioxidant Power (FRAP Assay). Microalgae were cultured in media with various salt concentrations (25, 50, 75, and 100 mM). As determined by the FRAP assay, CC-4101 type demonstrated the highest antioxidant activity and electron-donating capacity, with values of 22.59% and 229.42 micrograms ascorbic acid /mg extract, respectively. Using high-performance liquid chromatography (HPLC), the carotenoids in the extracts were analyzed, and it was discovered that CC-4101 type accumulated more zeaxanthin and lutein than CC-125 type, which potentially explains its enhanced antioxidant activity. Additionally, for the reason CC-4101 has not been investigated under conditions of salt stress, it is an excellent choice for a variety of future studies.

Keywords: *Chlamydomonas reinhardtii*, Antioxidant, Carotenoids, Salt concentrations

Effect of water regime on fruit quality of cherry tomato

Jirachaya Poomkokrak*
Kasetsart University, Bangkok, Thailand jirachaya.poo@ku.th

Kanin Rungwattana, Kasetsart University kanin.run@ku.th

Trend of cherry tomato consumption has increased in many countries. Although Thailand can produce cherry tomato all over the year, the fruit quality is usually unsatisfied for meeting a market quality standard. Global warming and more severe drought are one of the prime causes of the production and quality of fresh fruit and vegetable crops. Our present study aimed to examine a fruit quality of cherry tomato under different water regimes. When cherry tomatoes produced their first inflorescences, the plants were watered with three different regimes: everyday (control), every three days, and every seven days. There were 11 replicates per treatments and one plant for each replication. At 46 days after anthesis, fruit quality; fruit size, fruit water content, fruit sweetness, glucose and lycopene contents, was examined. Our results showed that cherry tomato exposed under watered every three days had the highest fruit size: 22.27 ± 1.75 mm in diameter, 32.80 ± 3.28 mm in length Plants exposed under watered every three and seven days had the highest fruit water content at 90.59 ± 5.59 and 88.59 ± 4.86 %, respectively. Total soluble solid was the highest in fruits under watered seven days at 7.59 ± 1.16 ° Bx. Glucose and lycopene contents were not significantly different for all treatments. We concluded that soil moisture content had an influence on fruit size, fruit water content, and sweetness in cherry tomato, but not for glucose and lycopene contents.

Keywords: cherry tomato, drought, flowering period, fruit quality, water regime

Effect of BA and NAA on *In vitro* shoot multiplication of *Hydrocotyle sibthorpioides* Lam.

Punchida Reuankeaw*
Kasetsart University, Bangkok, Thailand punchida.r@ku.th

Narong Wongkantrakorn Kasetsart University, fscinrw@ku.ac.th

Hydrocotyle sibthorpioides Lam. is a native aquatic plant of Thailand, popularly used in aquariums and now exported to several countries due to increasing demand. Plant tissue culture is a crucial technique for *in vitro* shoot multiplication for produce disease-free plants. Our study aimed to examine the effects of Benzyladenine (BA) and Naphthaleneacetic acid (NAA) on shoot multiplication in different explants, including node, petiole, and leaf. Three types of agar media, MS, MS supplemented with 1.0 mg/l BA and 0.5 mg/l NAA, and MS supplemented with 4.0 mg/l BA and 0.1 mg/l NAA, were used for culturing explants for 6 weeks. The result indicated that the best responding explant was the node cultured on MS agar medium supplemented with BA 1.0 mg/l and NAA 0.5 mg/l, producing the highest shoot number at 1.20 $\pm$ 0.42 shoots per explant and the highest shoot length was 1.06 $\pm$ 0.39 centimeters.The node was then tested on MS supplemented with BA at concentrations of 0, 1.0, 2.0 and 4.0 mg/l with NAA at concentrations of 0, 0.5 and 1.0 mg/l for 4 weeks. The results showed that the best responding media was MS agar medium supplemented with BA 2.0 mg/l and NAA 0.5 mg/l, with the shoot number was 2.00 $\pm$ 0.00 shoots per explant and the highest shoot length was 1.27 $\pm$ 0.45 centimeters. These results demonstrate the effects of BA and NAA on *in vitro* shoot multiplication of *H. sibthorpioides* and their potential for further application and commercialization.

Keywords: *Hydrocotyle sibthorpioides* Lam., Tissue culture, Aquatic plants, Shoot multiplication, Plant growth regulators.

Relationship between Altitude, Canopy Cover, and Terricolous Bryophyte Species Richness in Sakaerat Environmental Research Station

Siwaporn Jansantia*
Kasetsart University, Bangkok, Thailand siwaporn.jan@ku.th

Ekaphan Kraichak Kasetsart University ekaphan.k@ku.th

Sakaerat Environmental Research Station is an area for study, often the ecology of a tropical zone. There are many studies of the ecology of animals and lichens from this area, but no systematic study of the ecology of bryophytes, especially terricolous bryophytes, has been conducted. The purpose of this study was to study the relationship between altitude and canopy cover, and terricolous bryophyte species richness by surveying the species of bryophytes in dry evergreen and dipterocarp forests. A total of 46 sampling plots were placed in a dry dipterocarp forest by measuring the percentage of canopy cover, the density of bryophyte, and the altitude. The survey of bryophytes in dry evergreen and dipterocarp forests revealed 16 species, including mosses (14 species) and liverworts (2 species). The sampling plots in a dry dipterocarp forest revealed ten species of mosses. The results showed that the percentage of canopy cover and altitude did not affect the terricolous bryophyte species richness. However, the altitude affected the distribution of three species of terricolous bryophytes. Data from the study demonstrated the level of bryophyte diversity in the dry evergreen and dipterocarp forests. They provided the ecological database of terricolous bryophytes in the dry dipterocarp forest at Sakaerat Environmental Research Station.

Keywords: Bryophytes, Dry dipterocarp forest, Ecology, Sakaerat Environmental Research Station

Biomass in Durian(*Durio zibethinus* L.)in Different Day after Fruiting

Supasin Saikeaw*
Kasetsart University, Bangkok, Thailand supasin.sa@ku.ac.th

Kanapol Jutamanee Kasetsart University faaskpj@ku.ac.th

Durian (*Durio zibethinus* L.) is known as “king of fruit” which have high value in exporting market of Thailand. It is important to control a quality of durian.The quality of durian flesh fruit depends on the amount of starch and sugar.The objective of this experiment was to study the changes in starch and sugar content in durian fruit samples from 30 day to 140 day. The durian samples; husk aril and seed at different fruiting stage were collected every 15 days after fruiting. Starch and sugar content such as sucrose glucose and fructose, and carbohydrate content were analyzed. The accumulation of sucrose accordingly increase until 140 day in aril part. The accumulation of glucose and fructose trend to decreased after 60 day. In husk, it was found that the accumulation of fructose and glucose contents were constant from 60 to 140 day. In seeds, the accumulation pf fructose and glucose decreased from 75 day. The starch accumulation increased from 60 to 90 day, then the amount was decreased. The results it was confirm that there are a conversion of starch to sucrose in 90 day, and the highest accumulation of sucrose is happened at 140 days.

Keywords : Durian, Sugar, Carbohydrate

Selection of Kaolin Clay from Thailand as a Coating Substance for Reducing the Temperature of Tangerine Fruit

Pattama Mayai*
Kasetsart University, Bangkok, Thailand Pattama.may@ku.th

Kanapol Jutamanee Kasetsart University faaskpj@ku.ac.th

High temperatures and high light intensity cause sunburn of tangerine fruit. Sunburn is physiological disorders that decreases crop yield and quality. Therefore, kaolin clay from various sources in Thailand was studied In order to determine the properties that were suitable for use as a coating material and reduce the high temperature and high light intensity. The kaolin clay from five sources in Thailand–Mae Than, Lampang, Ranong, Narathiwat, SCG and Imerys, (the medicinal grade)–were selected to study the decreasing of light intensity, pH, precipitation and decreasing of tangerine fruit surface. The results showed that kaolin clays from Imerys and Mae Than have the property to use as a coating material due to appropriate pH value and slow to precipitate in water. The kaolin clay of 20g.L-¹ from Imerys and Mae Than have the light transmittance property that is most suitable for use as a coating material to reduce the temperature of fruits. The kaolin clay of 20 g.L-¹ and 30g.L-¹ from Imerys and Mae Than can reduce the temperature of fruits. The kaolin clay which is white color has the property to being a film coated fruit. Therefore, it can reflect high light and reduce heat received by fruit surface. Kaolin clay from Imerys and Mae Than at concentration of 20g.L-¹ are the most suitable for using as a coating substance for tangerine fruit.

Keywords: Kaolin Clay, Coating Substance, temperature, tangerine fruit

Taxonomy, Morphology, Anatomy and Pollen Morphology of the *Podocarpus* L'Hér. ex Pers. (Podocarpaceae) in Thailand

Pichet Chanton*
Kasetsart University, Bangkok, Thailand pichet.cha@ku.th

Chatchai Ngernaengsaruay Kasetsart University fsciccn@ku.ac.th

In this study, we present the taxonomy, morphology, anatomy, and palynology of the genus *Podocarpus* (Podocarpaceae) in Thailand. Detailed morphological descriptions and photo of the species are provided, along with information about the identification, distributions, the specimens examined, habitat and ecology, vernacular and names. The genus can be distinguished by its evergreen tree, dioecious plant; simple and spiral leaves, crowded at the apical part of branches, with single midrib; male cones in clustered; female cones with only one-seeded completely covered by a fleshy epimatium, subtended by an enlarged fleshy receptacle. Two species, *P. neriifolius* and *P. polystachyus* are reported. *P. neriifolius* is related to *P. polystachyus*, but differs in having its lamina linear or narrowly linear, sometimes narrowly oblong, 5.5–21.5 cm long, 1–2.5 cm wide and petiole 0.5–1 cm long (vs narrowly oblong or narrowly elliptic, sometimes oblanceolate, rarely linear, 1.8–5.0 cm long, 4–9 mm wide and petiole 1–5 mm long). The branch of *P. neriifolius* in the transverse section have many resin canals scattered in the cortex and tracheids in the vascular tissue, which indicates that it is a group of conifers (gymnosperms). The leaf blade in the transverse sections have resin canals in the spongy mesophyll layer. The vascular bundles in the midrib consist of tracheid above and phloem below, with vascular cambium between tracheid and phloem, transfusion tissue extends from the vascular tissue towards the leaf margins. The stomata are sunken, paracytic type, confined only to the lower surface. The pollen grains of *P. neriifolius* are monads, heteropolar, bilaterally symmetrical and bisaccate (with two bladder-like appendages called sacci). The pollen shape is oblate [polar axis length/equatorial axis length (P/E ratio = 0.55–0.69)], the polar axis length is 34.19–38.07 µm and the equatorial axis length is 53.07–68.43 µm. The pollen aperture is monocolpate and the exine sculpturing is reticulate.

Keywords: anatomy, gymnosperms, *Podocarpus*, Podocarpaceae, pollen morphology, taxonomy

Water Fleas (Moina sp.) Growth Enhancement Using Green Microalgae Chlorella sorokiniana (KU.B2)

Wanchock Chuenchom*
Kasetsart University, Bangkok, Thailand wanchok.c@ku.th

Nuttha Sanevas Kasetsart University, fscintsv@ku.ac.th.

Water fleas (Moina sp.) are good natural food and popular for aquaculture larvae feed, especially economic aquatic animals, but their abundances in nature are low. The enhancement of water fleas growth using green microalgae Chlorella sorokiniana (KU.B2) was determined to find a method for consistent growth of water fleas throughout the year by comparing our culture method with the culture with mixed algae, conventional water fleas feed in the aquaculture market. The mixed algae and C. sorokiniana were cultured in a liquid TAP (Tris-Acetate-Phosphate) medium. Twenty and 40 mL of log phase cells, two days after culturing, with an initial cell density of OD 1.6 at 750 nm, were added to a wide-mouth container with 1,000 mL of distilled water. Then water flea eggs were incubated and cultured under the fluorescent lamp at 50 µmol/m2/s with 14:10 dark/light photoperiods. The number and size of water fleas was measured every day for 4 days. The experiments were done with three replicates. The results found that the average number of water fleas was 1947±942 and 1,017±492 individuals/mL after being cultured by C. sorokiniana and mixed algae, respectively. The growth rate of water fleas was 486.75 and 254.25 individuals/day by feeding with C. sorokiniana and mixed algae, respectively. The water fleas' size was significantly larager in C. sorokiniana treatment than that of mixed algae at 0.00676 and 0.00495 cm, respectively. From this study, C. sorokiniana significantly promoted the growth of water fleas in both number and size ($P<0.05$). These results provide basic information and potential for water fleas cultivation using green microalgae C. sorokiniana which may benefit aquaculture applications in the future.

Keywords: Chlorella sorokiniana, Moina sp., TAP Medium, Mixed algae, aquaculture

Effect of Media Containing Calcium and Boron on "Nam Dok Mai" Mango Pollen Germination

Nisachon Sriphim*
Kasetsart University, Bangkok, Thailand nisachon.sr@ku.th

Kanapol Jutamanee Kasetsart University faaskpj@ku.ac.th

The problem of cultivation of "Nam Dok Mai" mango was low fruit set. The purpose of this study was to investigate the effects of different concentrations of calcium and boron-containing medium on pollen germination and fruit setting in "Nam Dok Mai" mango. To investigate fruit setting, three media were sprayed on mango growing in an experimental field, including Brewbaker and Kwack, Thussagunpanit, and Singh and Shono. After spraying media in the field, the pollens were collected and cultured in the Brewbaker and Kwack or Thussagunpanit media culture. The results showed that the Thussagunpanit medium showed had the highest pollen germination of 49.29%, which was 25.04% higher than the control. Spraying of Brewbaker and Kwack and Thussagunpanit formulas at day 7 showed the higher fruit set than spraying of Singh and Shono formula and control. On day 14, the Singh and Shono, Brewbaker and Kwack and Thussagunpanit formula had the better fruit set than control. The results demonstate that the proportion of calcium and boron concentrations in the Thussagunpanit medium had a noticeable increase in pollen germination, which may enhance fertilization and finally improve fruit setting in "Nam Dok Mai" mango.

Keyword : *Mangifera indica* L., fruit set, calcium, boron, pollen germination

Chemotaxonomy of some *Nymphaea* (Nymphaeaceae) in Thailand

Thararat Muak-in*
Department of Botany, Faculty of Science, Kasetsart University, Bangkok, Thailand
thararat.mu@live.ku.th

Theerachart Leepasert
Department of Chemistry, Faculty of Science, Kasetsart University
fscitcl@ku.ac.th

Chalermpol Suwanphakdee
Department of Botany, Faculty of Science, Kasetsart University
fscicps@ku.ac.th

The genus *Nymphaea* belong to Nymphaeaceae or water-lily family which they are well-known the gorgeous aquatic plants. There are 3 *Nymphaea* species were reported in Thailand as Bua Daeng (*Nymphaea rubra* Roxb. ex Andr.), Bua Phun-Bua Pheun (*N. nuchali* Burm.f.), Bua Khaw and Bua Khom (*N. pubescens* Willd.). Many species were used as traditional medicinal plants, especially, Bua Khom in Thai Ayurveda. Nowadays, Bua Khom was identified same as Bua Khaw because they are similar in white perianth but differ in many morphological characters. Some morphological characters of both plants are similar making to confused for identification and implementation. The chemical profiles or chemotaxonomy were used for support plant identification. The purpose of this study focused on comparing the chemical profiles of three plants as Bua Daeng, Bua Khom and Bua Khaw. The rhizomes of each plant were macerated with 3 solvents (hexane, ethyl acetate and methanol) for 7 days. The silica gel plates were sprayed with anisaldehyde reagent. The observation in 254 and 366 nm UV wavelength were examined. The results showed that the chemical profiles of Bua Daeng, Bua Khom and Bua Khaw are different. The chemical profiles of Bua Khom and Bua Khaw were shown significant identity and support the different morphology. Two plants should be separated species. Moreover, the morphology of Bua Khom and Bua Khaw are different in many characters. The plants should be separated scientific name. Bua Khaw still scientific name as *N. pubescens* Willd., but Bua Khom need more scientific evidences. Furthermore, it can not instead used Bua Khow for Bua Khom in the medicinal plant purposes. The chemotaxonomy is useful for support plant identification.

Keywords: Medicinal plants, Aquatic Plants, Chemical profiles,

Effect of Alternate Wetting and Drying on Panicle Development and Pollen Occurrence in *Oryza sativa* L.“Pathum Thani 1”

Preeyaporn Ponkang*
Kasetsart University, Bangkok, Thailand preeyaporn.pon@ku.th

Kanapol Juthamanee Kasetsart University faaskpj@ku.ac.th

Alternate wetting and drying is the method that suitable for situations of natural disasters such as drought, unseasonal rains. This method is an efficiently manage for water available to meet the needs of the rice plants. The purpose of this research was to study the effect of alternate wetting and drying on panicle development and pollen occurrence in *Oryza sativa* L.“Pathum Thani 1”. The treatments consist of the life-long watering control set and alternating wet and dry watering (AWD). In AWD treatment, water deficit was done during the vegetative stage at 35-45 day after sowing and during the reproductive at 60-65 after sowing. The period of water deficit was 7 days. The results show that when the rice was in the booting and flowering stages, there was no difference in the SPAD unit values of rice plants grown in wet and dry pattern compared to the control. However, pollen viability and seed set of AWD treatment were higher than the control. Therefore, the experiments demonstrated that alternate wetting and drying rice cultivation affects pollen development, which increase the seed set of rice.

Keywords : Alternate Wetting and Drying, Pathum Thani 1, Panicle Development, Pollen

Effect of Glucose and Nitrogen on Polyhydroxylbutyrate (PHB) Production of Cyanobacteria *Nostoc* sp. (KU.B4)

Supapich Sanit*
Kasetsart University, Bangkok, Thailand supapich.sa@ku.th

Nuttha Sanevas Kasetsart University, fscintsv@ku.ac.th.

Plastic is inevitably associated with everyday life; most plastics are made from petrochemicals. This material is not sustainable and has difficulty decomposing properties, which can lead to global warming and thus increase the amount of plastic. This is the reason for the study on producing substitute plastic from sustainable materials that can quickly decompose and not harm the environment or life. This research aimed to investigate the effect of glucose and nitrogen on polyhydroxylbutyrate (PHB) production of cyanobacteria *Nostoc* sp. (KU.B4). The cyanobacteria *Nostoc* sp. (KU.B4) was cultured in a BG-11 liquid medium with and without nitrogen. The initial cell density of *Nostoc* sp. was set at 0.06 with the wavelength 560 nm. The content of PHB was determined 12 days after treatments. The results showed that culturing in BG11 without glucose and in BG11 with 0.8% glucose gave no difference in the yield of PHB at 35.1%. Moreover, adding the nitrogen source as $NaNO_3$ in the medium did not affect the PHB formation of *Nostoc* sp. (KU.B4).

Keywords: Cyanobacteria, *Nostoc* sp., Polyhydroxylbutyrate, Glucose, Bioplastic

Trichome diversity on *Plectranthus amboinicus* (Lour.) Spreng. Leaves: Anatomy, Morphology and Histochemistry

Sartikar Onwong *
Kasetsart University, Bangkok, Thailand sartikar.o@ku.th

Pornsawan Sutthinon Kasetsart University pornsawan.sut@ku.th

Plectranthus amboinicus (Lour.) Spreng. is a perennial shrub frequently used in folk medicine. The young leaf has been used to treat fever and colic, while abdominal pain and period flu are treated with old leaf. Generally, the majority of the essential substances are accumulated in the leaf trichomes. This research aims to compare the diversity, anatomy, morphology, and histochemistry of trichome on *P. amboinicus* leaves at different developmental stages, based on light and electron microscopy. The results showed that 8 types of trichomes were characterized including 6 types of glandular trichome and 2 types of non-glandular trichomes. The trichome density in young leaf (8.82 trichomes/mm^2) was higher than in old leaf (4.12 trichomes/mm^2), and non-glandular trichome in both young and old leaf had higher density than glandular trichome. However, carbohydrates, protein, and lipids can be found in trichomes of both young and old leaves, but the accumulation is different. Young leaves had short-stalked trichomes contained more protein and carbohydrates than older leaves, while lipid accumulation in bulb-shape head trichome was higher than young leaves. Therefore, leaf age does not affect trichome diversity, but affect the number of trichome and the accumulation of certain substances especially lipid; the older the leaves, the fewer number of trichome and the higher lipid accumulation. The results can be used as a baseline for further observation in an important substance of *Plectranthus amboinicus* (Lour.) Spreng.

Keyword: *Plectranthus amboinicus* (Lour.) Spreng., Histochemical analysis, Medicinal plant, Trichome, Leaf age

Development of primer set to identify Cannabis sativa varieties

Chanikarn Wetchapan*
Kasetsart University, Bangkok, Thailand chanikarn.we@ku.th

Sompid Samipak Kasetsart University Sompid.s@ku.th

Hemp (*Cannabis sativa*) is a plant that originated in Central Asia but has since spread to East Asia, India, and Europe. In this study, 41 samples with designed primers were used. Based on previous research, the hemp samples were classified into four groups, and a total of 14 primer sets were designed to differentiate between hemp strains. The optimal conditions for Polymerase Chain Reaction (PCR) in hemp samples with all 14 SNPs primer sets were examined. The results revealed specific bands at temperatures over 50 °C. Some primers were able to achieve optimal conditioning resulting in clear DNA fragments of interest, but many primers have not been fully conditioned. In the future, more $MgCl_2$ concentrations need to be investigated.

Keywords: Polymerase Chain Reaction, Conditions, SNPs primer.

Duckweed and bacteria co-cultivation reduces nitrogen in swine

Phakaporn Wongpudpad*
Kasetsart University, Bangkok, Thailand, phakaporn.wo@ku.th

Peerapat Roongsattham Kasetsart University, peerapat.ro@ku.th

Duckweeds are tiny flowering aquatic plants with five genera (*Landotia*, *Lemna*, *Spirodela*, *Wolffia*, and *Wolffiella*) and are models for plant research. Duckweeds have now caught the interest of the public because of their various uses in agriculture, animal feed, human food, and bioenergy. Duckweeds can grow rapidly and be used as phytoremediators, which is an important role (Acosta et al., 2021). Bacteria that can promote plant growth and perform other functions are called plant growth promoting bacteria (PGPB) (Yoneda et al., 2021). Two bacteria, HbKU8.0450 and HbKU8.0596, isolated from duckweeds, were used in this experiment. Both bacteria were previously proven to have a beneficial effect on growth. Hence, we reported that *Lemna minor* and bacteria HbKU8.0450 and HbKU8.0596 co-cultivations promoted the growth of duckweed and possibly reduced nitrogen in Hoagland media and swine media. In the Hoagland experiments, HbKU8.0450 and HbKU8.0596 improved the growth of duckweeds in terms of plant area by up to 1.65 and 1.51 times, respectively. In the swine experiments, HbKU8.0596 improved plant area by up to 1.62 times, suggesting that bacteria enhanced the growth of duckweeds in both conditions. In terms of nitrogen removal, the co-cultivations of duckweed with the bacteria HbKU8.0596 reduced nitrogen in both conditions but not differently than the control. The difference between duckweeds and the co-cultivations of duckweed with bacteria in terms of nitrogen reduction was unclear. At some point, however, the rapid growth of the duckweeds with HbKU8.0596 will accelerate nitrogen depletion faster than the control. The 16S rRNA genes of both isolates were blasted to EZBioCloud, and it was determined that HbKU8.0450 and HbKU80.596 were *Enterobacter* sp. and *Staphyloccus* sp., respectively. *Enterobacter* was reported to promote plant growth in terms of stimulating root growth in terrestrial plants and increasing the weight of the plant (Jomkhame et al., 2021). In this experiment, *Enterobacter* (HbKU8.0450) was co-cultured with duckweeds. *Enterobacter* (HbKU8.0450) also promoted the growth of duckweeds, but it needs further analysis of the interaction between bacteria and duckweed in terms of molecular response.

Keywords: duckweed, *Lemna*, nitrogen, PGPB, plant growth promoting bacteria

Rapid identification of Earthstar Mushroom using species-specific amplification technique

Yatawee Foongchomchoi*
Kasetsart University, Bangkok, Thailand yatawee.f@ku.th

Mingkwan Nipitwattanaphon Kasetsart University fscimkn@ku.ac.th

Earthstar mushrooms (*Astraeus sp.*) form ectomycorrhizal associations with plant roots, which can greatly benefit agricultural and forest productivity. Identification of this mushroom especially in the form of hyphae in plant roots can be done by using *ITS* (Internal transcribed spacer) sequence. However, this method is time-consuming and costly for testing large numbers of samples. In this study, species-specific primers were designed and tested on three species of Thai earthstar mushrooms: *A. asiaticus*, *A. odoratus*, and *A. sirindhornii*. It was found that all primers were indeed species-specific. Furthermore, 21 root samples from eight infected plantlets were tested. However, only three samples were found to be specifically amplified by the primer of *A. odoratus*. Two of which were roots infected by *A. odoratus* while the other one was root infected by *A. asiaticus*. This suggests an ineffective infection process in the plantlets.

Keywords: Earthstar mushrooms**,** Ectomycorrhizal**,** Species-specific primers

Genetic Diversity of Tomato (*Solanum Lycopersicum*) varieties Using Start Codon Targeted (SCot) Markers

Pornthip Nakthae*
Kasetsart University, Bangkok, Thailand pornthip.n@ku.th

Chatuporn Kuleung Kasetsart University fscictp@ku.ac.th

Tomato (*Solanum lycopersicum*) is one of the most important vegetables worldwide with diverse shapes, sizes, and colors depending on the variety. It belongs to the Solanaceae family and is a diploid plant with 24 chromosomes (2n = 2x = 24). The species originated in the tropical zone of Central and South America. Genetic diversity is crucial for its breeding programs to enhance desirable traits such as yield, biotic and abiotic stresses. Start codon targeted (SCoT) markers, a PCR-based technique, can be used to scan multiple genomic regions at the same time. It is an efficient technique for studying genetic diversity. Therefore, this study aimed to investigate the genetic diversity of 22 tomato varieties and one Thai eggplant using seven SCoT markers. A total of 138 bands were amplified with 19.7 bands per primer. All amplified bands were polymorphic with polymorphic information content (PIC) values ranging from 0.33 to 0.50 (an average of 0.46). The simple matching (SM) similarity coefficient between the tomato group and the Thai eggplant group was 0.17, while the coefficient between two tomato varieties ranged from 0.84 to 1 with an average of 0.951, indicating that the tomato group has a low level of genetic diversity. The dendrogram constructed based on the SM similarity using the unweighted pair group method with arithmetic mean (UPGMA) clustering method showed that the 22 tomato varieties could be divided into five subgroups. For further investigation, phenotypic information is required to assess relationship between genotypes and traits.

Keyword: Tomato, *Solanum lycopersicum*, Genetic diversity, Start codon targeted

Hunting olfactory receptors in silk moth

Chonnaphat Srisaknok
Department of Genetics, Faculty of Science, Kasetsart University, Bangkok, Thailand
chonnaphat.sr@ku.th

Anchanee Kubera*
Department of Genetics, Faculty of Science, Kasetsart University, Bangkok, Thailand
fsciacs@ku.ac.th

The silk moth is an economically important insect to silk production and planting mulberries to feed silkworms. The spawning behavior of the silk moth has a different host selection, affecting the industry's control of silk production. The objective of this study was to examine the gene expression levels of olfactory receptors in *Bombyx mori* silk moth in different conditions for spawning. The expression of nine olfactory receptor genes of *Bombyx mori* Nang Lai (NL) was observed along with the spawning behavior. Several conditions for spawning were conducted, such as mulberry leaves, and mulberry powder in different concentrations. After the spawning, the eggs were counted, and the antennae were collected. The total RNA was extracted and the qRT-PCR was performed. The results showed that the expression levels of olfactory receptor genes in various conditions were found significantly different. Moreover, the expression levels of each condition either gradually decreased or increased compared to that of the control. This research will be further investigated to explore the relationship between the expression of olfactory receptor genes and the spawning behavior of the silk moth.

Keywords: olfactory receptors, gene expression, *Bombyx mori*, qRT-PCR

Study of root induction medium and chromosome duplication in Thai mulberry (*Morus* spp.) using colchicine treatment.

Natnicha Thumthuan
Department of Genetics, Faculty of Science, Kasetsart University, Bangkok, Thailand
natnicha.thu@ku.th

Chatchawan Jantasuriyarat
Department of Genetics, Faculty of Science, Kasetsart University, Bangkok, Thailand
fscicwj@ku.ac.th

Mulberry (*Morus* spp.) is an economically important plant mainly used in the sericulture, pharmaceutical, and cosmetic industries. Mulberry is the only plant that is used for silkworm rearing. The quality of silk cocoons depends on mulberry leaves. Therefore, the selective breeding of mulberry for high yield and arid tolerance affects the quantity and quality of silk cocoons. Polyploidy induction is a very popular method of breeding plants to achieve the desired characteristics. Polyploid is the multiplication of chromosomes by colchicine treatment. In order to double the chromosome sets in mulberry, root induction medium is required. Therefore this study aimed to identify the appropriate root induction medium for four recommended Thai mulberry varieties. Moreover, the chromosome number of Thai mulberry varieties was increased using colchicine treatment. The explants were cultured on a total of 18 different types of root induction medium, and subsequently treated with a 0.05% colchicine solution for a duration of 24 hours. Using flow cytometry, the number of chromosome sets was counted and survival rates were studied. According to the results, three root-inducing media can induce roots in Buriram 60, and one can induce roots in Sakhonnakorn 85. The polyploid induction study showed a survival rate of 16.67% for Sakhonnakorn 85, 4.76% for Sakhonnakorn 85, while Burirum 60 and Srisaket 84 had a 0% survival rate. However, the determination of the chromosome number by flow cytometry showed that the treatment with 0.05% colchicine and soaking for 24 hours could not induce an increase in the number of chromosome sets.

Keywords: Polyploid, Colchicine, Mulberry, Tissue culture.

Norflurazon resistance in *Chlamydomonas reinhardtii*

Ploypailin Sangthong
Kasetsart University, Bankok, Thailand Ploypailin.Sang@ku.th

Anchalee Sirikhachornkit Kasetsart University Anchalee.sirikhachornkit@gmail.com

Chlamydomonas reinhardtii is a model organism which growth can be controlled in the lab. It was used to study genetics and mutations as well as plant photosynthesis. The herbicide norflurazon was therefore examined to decrease the pigment structure that relates to the important process of photosynthesis in plants. Norflurazon herbicide resistance was examined using Chlamydomonas reinhardtii as a model organism. Norflurazon inhibits the synthesis of pigments required for photosynthesis, which inhibits phytoene synthase, a crucial enzyme that induces the synthesis of carotenoids, from being active. In the lack of an increase in carotenoid synthesis, plants lack the pigments required to absorb light energy, which produces chlorophyll degradation and the ultimate death of plant cells. According to research, Phytoene desaturases (PDS) variants can grow in a concentration of 150 mM of norflurazon. In another research, Chlamydomonas can survive in extremely harsh environments, based on the intensity of the stress (Juan Lu et al., 2019) Chlamydomonas is capable of signal transduction to incompletely ruining cells to require the residual cells to survive. Moreover, 20 *Chlamydomonas reinhardtii strains were* identified and analyzed for norflurazon herbicide resistance, the impacts of norflurazon on photosynthesis and carotenoid synthesis were examined norflurazon sensitive and norflurazon resistant strains were compared for further investigative process.

Keyword: *Chlamydomonas reinhardtii,* Norflurazon, Carotenoid

Gene silencing in *Anopheles dirus* using dsRNA

Phitchayatida Promkuttikaew
Department of Genetics, Faculty of Science, Kasetsart University, Bangkok, Thailand
Phitchayatida.p@ku.th

Anchanee Kubera*
Department of Genetics, Faculty of Science, Kasetsart University, Bangkok, Thailand
fsciacs@ku.ac.th

Malaria is a deadly infectious disease caused by Plasmodium spp., which are transmitted by anopheline mosquitoes. In this study, we investigated four genes of Anopheles dirus that were increased after Plasmodium vivax infection. The objective was to study the gene expression levels after feeding the mosquitoes with double strand RNA (dsRNA) targeting the cuticular protein family RR-2 (ADIR001095), far upstream element-binding protein (ADIR000228), peptidase212 (ADIR01555), and kraken (ADIR000286) genes using quantitative *real time polymerase chain reaction* (qRT-PCR). The results revealed the reduction of gene expression levels suggesting that dsRNA technique was successfully used to knock down the target genes. These findings provide further validation for the potential use of these genes in controlling the spread of malaria.

Keywords : *Anopheles dirus*, Plasmodium, Malaria, gene expression, qRT-PCR

Studying colony structure of *Polyrachis furcata* to identify the number of queens and males using targeted microsatellite sequencing

Worawan Boonprakanpai *
Kasetsart University, Bangkok, Thailand worawan.b@ku.th

Mingkwan Nipitwattanaphon Kasetsart University mingkwan.n@ku.th

Ants in the genus *Polyrhachis* are highly diverse with 12 subgenera and about 500 described species. In addition, they have various nesting behavior and colony structure with both single and multi-queen presence. *P. furcata* is abundant in Thailand and their colony structure has not been studied systematically. Microsatellite marker is generally used for study colony structure in ants (i.e. number of queens and mated males). Here, targeted microsatellite sequencing was applied to reduce the cost especially at the step of verifying of polymorphism in each locus compared to traditional method. Of the nine loci verified, we obtained the results from only eight loci. Of these, number of alleles ranged from three to 30 and PIC ranged from 0.091 to 0.897. PrFR1 was the most informative marker, with 30 alleles and PIC of 0.897; PrFR5 was the least informative marker with the PIC of 0.0910. Thus, targeted microsatellite sequencing can be applied for selection of microsatellite markers and further colony structure study in *P. furcata.*

Keyword: Ant, *Polyrhachis furcata*, Microsatellite

Comparative genome analysis of *Neisseria shayeganii* strains from dogs and cats

Warumporn Khuenwang
Kasetsart University, Bangkok, Thailand warumporn.kh@ku.th

Teerasak E-kobon
Kasetsart University fscitse@ku.ac.th

Neisseria shayeganii is a pathogenic bacterium found in humans and animals including dogs and cats. The bacterium can be transferred to humans through wound infection. This bacterium causes skin infections or severe infections in the respiratory tract. Information on *N. shayeganii* genetics was limited compared to other *Neisseria* species. This study aimed to analyze the genomes of *N. shayeganii* from cats and dogs in Thailand and compare them with the genomes of other *Neisseria* species and *N. shayeganii* strains. Five bacterial isolates were cultured, and the species were confirmed by 16S rRNA sequencing. The genomes of these samples were sequenced using next-generation whole-genome sequencing on the Illumina short-read sequencing platform with a library size of 100 – 300 bp. Draft genomes of these five samples had an average genome size of ~2.20 Mb and consisted of 33-70 contigs with a GC content of ~56.70%. Genes responsible for drug resistance and pathogenesis were identified in all samples. Comparative genome and proteome analysis revealed that the samples V113 and V131 had more variations than those of other samples. This difference was consistent with the 16s rRNA phylogenetic result confirming the separation of these five *N. shayeganii* isolates, and some of them could be further analyzed for the confirmation of new strains or species. The genome and proteome comparison showed that these five isolates of *N. shayeganii* from cats and dogs in Thailand were heterogeneous. Different patterns of specialty genes suggested their varying degrees of virulence and pathogenicity. The findings of this study are useful for the examination of new bacterial isolates and their potential pathogenic mechanisms which help develop preventative methods for pet health.

Keywords: *Neisseria shayeganii*, pathogenic bacteria, genome analysis, cats, dogs

Effects of some bacteria species on duckweed growth (*Landoltia punctata*)

Salaleewan Yawichai*
Kasetsart University, Bangkok, Thailand salaleewan.y@ku.th

Duckweed is a fast-growing, easy-to-feed aquatic plant with high starch and protein content. They are aquatic plants that could double their fronds within a few days and be used as phytoremediators, which is an important role. However, plant-growth-promoting bacteria (PGPB) are bacteria that can promote plant growth and function, and they can enhance plant growth and protect plants from disease and abiotic stresses through a wide variety of mechanisms. In this experiment, we aimed to identify whether the plant growth promoting effects of eleven PGPB for *Lemna aequinoctialis* have the same effect for *Landoltia punctata*. Three bacteria that have been reported from Japan: *Pseudomonas sp.* (PS6), *Acinetobacter calcoaceticus* (P23) and *Sinorhizobium sp.* (SP4) were also included. They were PGPB in duckweed and generally have a high adhesion capacity on solid inorganic and organic substrates, and many studies have been reported on the mechanism of biofilm formation and its application. At day 14 after bacterial inoculation, duckweeds were measured for fresh weight, dry weight, plant area, frond numbers, and grayscale of the green channel (which negatively correlates to chlorophyll). The eleven isolates and three bacteria from Japan demonstrated a plant-growth-inhibiting effect ($p < 0.05$) to *Lantodoltia punctata*. These results provide information on the possibility that the eleven bacteria and three bacteria from Japan were plant-growth-promoting in *Lemna aequinoctialis* but plant-growth-inhibiting in *Lantodoltia punctata,* and they were specific to duckweed species. This phenomenon can be explained by the specificity of bacteria for specific plant species. All bacteria isolates were sequenced for 16S rRNA and blasted to the EZBioCloud database, and they were gram-stained to identify the gram and shape.

Keyword: duckweed, *Landoltia*, plant-growth-inhibiting bacteria, plant-growth-promoting bacteria, PGIB, PGPB

Effect of salinity-induced stress and temperature acclimation studies in *Chlamydomonas reinhardtii*

Sopita Phummaree*
Kasetsart University, Bangkok, Thailand sopita.ph@ku.th

Anchalee Sirikhachornkit Kasetsart University anchalee.si@ku.ac.th

Algae are photosynthetic organisms that contain pigments which are essential elements for photosynthesis. Some algae may produce metabolites that may be toxic to cells depending on different environmental conditions. Algae can produce various valuable substances under different stress conditions such as nutrients, air, light, temperature, acidity and salinity. Salinity stress is one of the major environmental factors affecting physiological and biochemical pathways involved in microalgae growth and development. Sodium chloride (NaCl) is the main salt that causes salinity. High salinity levels induce ionic, osmotic and oxidation stress. Microalgae under salt stress produce ROS (reactive oxygen species) so the cell has a mechanism to deal with the stress. *Chlamydomonas reinhardtii* is a single celled algae and one of the most studied microscopic organisms in biological research. *C. reinhardtii* can easily be grown in liquid and solid media. Therefore, we studied the stress response of different strains of this species. Growth of two salt tolerant strains, including cc2343 and cc4414, was compared with that of a salt sensitive strain 4A+ under various concentrations of sodium chloride (NaCl), Rose Bengal (RB) and Hydrogen peroxide (H_2O_2). The adaptation of these strains was also studied under different temperatures of 4, 10, 37 and 42°C.

Keyword: *Chlamydomonas reinhardtii*, Sodium chloride, ROS.

Development of a Fluorescence Detector for a Microfluidic Device as a Part of Biological Dosimeter

Timpika Pulpirom*
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand Timpika.pu@ku.th

Wanwisa Sudprasert
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand fsciwasu@ku.ac.th

Nuclear technology plays an incredibly important role in various fields including industries, energy, medicine, and research. The biological dosimeter is essential as it allows for the assessment of biological responses to radiation exposure and the evaluation of the impact of radiation on individuals. Therefore, the developed tools for biological dosimeters must be fast, cost-effective, and easy to use to ensure efficiency. Microfluidic devices, which are related to the theory of microscale fluid flow, can aid in the convenient, rapid, and cost-effective measurement of biological radiation levels. In this regard, this research aims to study and develop a fluorescence sensing device to be used in microfluidic devices for analyzing gamma-H2AX foci, which is a biological marker for radiation exposure. However, due to the high cost of fluorophores, the device must be designed to operate with minimal amounts of these chemicals to reduce the cost of the investigation. The developed fluorescent signal detector consists of silicon photomultipliers that can measure light intensity as low as a single photon. It is expected to be applied to microfluidic devices for effective gamma-H2AX foci analysis in the future.

Keywords: Microfluidic, Biodosimetry, γ-H2AX, Lymphocytes, Ionizing radiation

In vitro screening of Cordyline mutants tolerance to salinity stress of NaCl

Vasita Kaewngam,[1], Katarat Chutinanthakun [2]
[1] Department of Applied Radiation and Isotope, Faculty of Science, Kasetsart University, Bangkok 10900, Thailand vasita.k@ku.th

In vitro culture plantlets of cordyline were grown on MS medium supplement with 3 different concentrations of NaCl 0, 20, and 40 mM. Effects of salt stress on survival plantlets, plant height, leaf number, and root number were determined. Data were recorded at 30 and 45 days. The results showed that 40 mM NaCl revealed significantly different lowest on the number of survival plantlets, plant height, leaf number, and root number compared to the control (0 mM). Fourty-eight plantlets of which were exposed to gamma-ray and subcultured on MS medium until M1V6 generation on a previous study were used for *in vitro* screening of salt tolerant plant. Under 20 and 40 mM NaCl, three mutant lines were selected. Analysis of lipid peroxidation was performed by MDA assay in order to understand the stress response of the three mutant lines. The results showed that all three mutant lines revealed significantly lower MDA content compared to the original variety.

Keywords: In vitro screening, Salt tolerance, *Cordyline fruticosa L.*, Salinity stress

Manufacturing of gamma-ray shielding sheets from bamboo sheets with the addition of bismuth oxide.

Wanaree Lanploy*
Kasetsart Univrsity, Bangkok, Thailand Wanaree.l@ku.th

Kiadtisak Saenboonruang Kasetsart Univrsity fscikssa@ku.ac.th

Electromagnetic wave radiation, including X-rays and gamma rays, are nowadays utilized in both industrial and medical applications. Individuals who engage in the radiation work are thus more likely to be exposed to radiation than people in general. The high contact with radiation can cause health issues such as body tissue damage, nausea, vomiting, fatigue, hair loss, headache, diarrhea, cancer, and leads to death. As a result, radiation protection is required, and the materials used for radiation protection must have qualities that reduce the intensity of radiation exposure by absorbing or scattering radiation from its source. Therefore, the purpose of this research is to investigate the effect of the bamboo composite material and ratio Nano-Bismuth Oxide of composites /gamma protective filler of the composite material at the ratios of 0, 12.5, 25, and 50 wt% of nanoparticle-size bismuth oxide on the morphology, including the properties of anti-gamma of the bamboo sheets when nanoparticle-size bismuth oxide is added. And, it demonstrated that increasing the nanoparticle-size bismuth oxide ratio had no effect on protecting against radiation. Furthermore, morphological testing indicated that nanoparticle-size bismuth oxide adhered to the surface but failed to penetrate into the inside.

Keywords: bamboo sheets, Bismuth Oxide, Gamma rays, Radiation Shielding.

Antioxidant Activity and Radioprotective Effect of the extract from Cardamom (*Amomum cardamomum* L.) and Kampot Red Pepper (*Piper nigrum* L.)

Sasithorn Yimsaard*
Kasetsart University, Bangkok, Thailand sasithorn.yi@ku.th

Paiboon Reungpatthanaphong Kasetsart University fscipbr@ku.ac.th

Herbal plant have been widely used as traditional medicine for a long time due to their beneficial antioxidants. The objectives of this study were to determine antioxidant activity and radioprotective effect of Cardamom tree (*Amomum cardamomum* L.) and Kampot Red Pepper (*Piper nigrum* L.). Antioxidant activity was determined using Scavenging activity on 2,2-diphenyl-1-picrylhydrazyl radical scavenging activity (DPPH assay) and 2,2'-azino-bis (3-ethylbenzthaiazoline-6-sulpholic acid) radical cation decolorization assay (ABTS assay). The total phenolic content of the extracts was measured using Folin-Ciocalteu method. The result demonstrated that the ethanolic extract of Kampot Red Pepper showed the highest antioxidant activities in DPPH and ABTS assay (EC_{50} value of 197.75 ± 2.46 µg/mL and 104.43 ± 2.94 µg/mL respectively) when compared to Cardamom tree extract (EC_{50} value of 1,612.53 ± 4.71µg/mL and 669.26 ± 1.57 µg/mL respectively). Through the determination of phenolic compounds, it was found that the total of phenolic content in Kampot Red Pepper extract (44.37 ± 0.0021 µg/mL) was higher than that in Cardamom extract (31.70 ± 0.0031 µg/mL). Radioprotective effect was studied using MTT assay on TK6 cell. Moreover, Kampot Red Pepper exhibited the highest ability of radioprotective effect. In conclusion, Kampot Red Pepper trends to possess antioxidant activity and radioprotective effect.

Keywords: Cardamom (*Amomum cardamomum* L.), Kampot Red Pepper (*Piper nigrum* L.), Antioxidant activity, Radioprotective effect

Measurement of Radionuclides in Roasted Cashew Nut by Gamma Spectrometry with High-Purity Germanium (HPGe) Detector

Siriporn Thonganan*
Kasetsart University, Bangkok, Thailand Siriporn.thonga@ku.th

Paiboon Reungpatthanaphong Kasetsart University fscipbr@ku.ac.th

The Consumption of food contaminated with radioactive substances cause increase the amount of radioactivity in the human body which may pose a risk to cancer. The measurement of radioactivity in food products seem to be the way to prevent the risk of Consumption. The purpose of this research was to measure radionuclide content in roasted cashew nuts from randomly six areas in Thailand by gamma spectrometry with high-purity germanium probe. The results showed the most common radionuclide content was K-40 which could be found in roasted cashew nuts from six areas. Cs-137 was found only in roasted cashew nuts form Si Saket Province but Ra-226 and Th-232 were not found in all samples. The highest specific activity value of the radionuclide K-40 was shown in product B which could not identify the source. Moreover, the value of K-40 in product B was close to the value of K-40 found in Uttaradit and Nakhon Si Thammarat Provinces which based on the granite-geochemical nature of soil leading to higher accumulate K-40 in plants nearby. However, the specific activity values of K-40 and Cs-137 which found in roasted cashew nuts form randomly six areas in Thailand were within the range of the standard (UNSCEAR,2000)

Keywords: Radionuclide, High-purity germanium, Gamma spectrometry

Effects of Gamma Irradiated Chitosan on Mechanical and Morphological Properties of Natural Rubber Gloves

Piyada Jongjaroen*
Kasetsart University, Bangkok, Thailand piyada.jo@ku.ac.th

Kiadtisak Saenboonruang Kasetsart University fscikssa@ku.ac.th

This research is study effects of gamma irradiated chitosan on mechanical and morphological properties of natural rubber gloves. Conducting studies and testing of natural latex composites and chitosan 30 kGy irradiated at 0, 4, 8 and 12 parts per hundred parts of rubber by weight (phr) affecting the Mechanical properties and Morphology of Natural latex gloves when chitosan irradiated is added in composite natural latex. Sulfur vulcanization and Dipping process of latex were used in this research. The results showed that the mechanical properties of natural latex composites with the addition of chitosan irradiated fillers changed. Tensile modulus at 500% elongation tends to increase compared to composites without filler. Tensile strength and %Elongation at break tend to decrease with increasing filler content. Morphological testing found that as the filler content increased, the chitosan particles increased adhered to the rubber material, evenly distributed, and Density of chitosan per area also increased.

Keyword : Natural Rubber, Mechanical properties, Morphology, Chitosan, Gamma radiation

Effect of bismuth oxide on Gamma ray shielding properties rubber wood sheets.

Thanaporn Pengprang*
Kasetsart University, Bangkok Thailand thananporn.pe@ku.th

Kiadtisak Saenboonruang Kasetsart University fsciksa@ku.ac.th

X-rays and gamma are currently used in a wide range of medical applications. Agriculture and industries, but an extranet is an energy-efficient electromagnetic wave that has formed radiation. Ions that are hazardous to humans and the environment if the person performing the radiation is exposed to too much radiation. May affect health and body to people on the job, such as the risk of developing a cancer cell, or causing. As such, the radiation barrier material is essential for the prevention of such radiation, particularly for the person performing the task. Radiation can prevent and reduce the potential for over-exposure. The study is intended for the production of sheets. The rubber wood used to prevent gamma by adding bismuth oxide (nano-Bi_2O_3) with a concentration of 0 12.5 25 and 50 percent with a weight to mechanical property and morphology from research. The average gamma count is less likely to be based on increased additive concentration in morphology tests. As additive volume increases, bismuth oxide particles (nano-Bi_2O_3) attached to the rubber slab increase.

Keyword: Rubber Wood, Bismuth oxide, Gamma ray shielding

Measurement of Radionuclides in Roasted Almond by Gamma Spectrometry with High Purity Germanium (HPGe) Detector

Chirata Channawa *
Kasetsart University, Bangkok, Thailand chirata.c@ku.th

Paiboon Reungpatthanaphong Kasetsart University fscipbr@ku.ac.th

The aim of this study was to measure the natural radionuclides K-40, Ra-226, Cs-137 and U-235 in four products of roasted almond. Two products A and B were purchased from the supermarket, one product C was purchased from the local market, and D was purchased from the retail store. In order to measure gamma rays, a high-purity semiconductor probe (HPGe) was used. The results revealed that the most common radionuclide content was K-40. The highest and the lowest specific activity value of K-40 were shown in product B (1.605 Bq/Kg) and product A (1.486 Bq/Kg), respectively. However, Cs-137 was found only in product D with showed a specific activity value 0.010 Bq/Kg. The values of the specific activity were range from 1.486-1.605, 0.0131-0.0172, 0.00-0.010 and 0.079-0.105 Bq/Kg in K-40, Ra-226, Cs-137 and U-235, respectively. However, the specific activity values and annual effective dose equivalent of roasted almond samples were accepted by the criteria for Radionuclide Activity Concentrations for Food and Drinking Water of FAO/WHO, UNSCEAR and TINT.

Keywords: Roasted Almond Products, Radionuclides, Gamma Spectrometry, High Purity Germanium Detector

Investigation of the Effect of Roasting Condition on the Elemental Composition of Arabica and Robusta Coffee Beans by X-Ray Fluorescence Spectroscopy

Thanuch Boujamrat*
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand thanuch.b@ku.th

Wanwisa Sudprasert
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand fsciwasu@ku.ac.th

Coffee is a widely consumed beverage worldwide, typically made from Arabica and Robusta coffee beans. The quality of the coffee is affected by the roasting process, with different roasting levels, such as light, medium, and dark roast, producing distinct flavors and aromas. This research project aimed to investigate the effects of roasting conditions on the composition of coffee beans, using the Energy Dispersive X-ray Fluorescence Spectrometer (EDXRF) model M4 Tornado to analyze the types and distribution of trace elements in raw and roasted coffee beans. Our findings indicated that the trace elements present in raw and roasted coffee beans differed significantly. The elements identified in both types of beans included K, Ca, S, Cl, Mg, P, Mn, Al, Fe, Cu, Zn, Si, Sr, and Rb. K and Ca were uniformly distributed in the coffee beans, with Ca predominantly concentrated in the middle of the bean. The different roasting levels affected the trace elements in the coffee beans, with K, Ca, S, Cl, P, Al, Fe, Si, and Rb differing significantly at the 0.01 significance level. Mn and Sr differed at the 0.05 significance level, while Mg, Cu, and Zn did not show any statistical differences. These findings may help to better understand the effects of roasting on the chemical composition of coffee beans, ultimately improving the quality of the beverage.

Keywords: Energy dispersive x-ray fluorescence, Roasted coffee beans, M4 tornado, Elemental mapping.

Antioxidant Activity and Radioprotective Effect of the extraction from Galangal rhizome (*Alpinia galanga L.*) and Yellow Galangal rhizome (*Alpinia galanga L.*)

Thunmon Komolsiriphakdi*
Kasetsart University, Bangkok, Thailand Thunmon.k@ku.th

Paiboon Reungpatthanaphong Kasetsart University fscipbr@ku.ac.th

This work aimed to investigate the ability of antioxidants and radioprotective effect of the extraction form galangal rhizome and yellow galangal rhizome. Previous studies have been studied that reported galangal was a potent source of antioxidants. Antioxidant activity was analyzed by DPPH assay and ABTS assay. The results showed that the yellow galangal rhizome extract had higher antioxidant activity and higher total phenolic content (87.65 mg GAE/g sample extract). In addition, all extractions were studied radioprotective effect by MTT assay. Yellow galangal rhizome extract trended to have higher radioprotective effect than galangal rhizome extract. However, preclinical studies should be performed to confirm their efficacy and toxicity.

Keywords : Antioxidant activity, Radioprotective, Galangal extract, Phenol compounds

Effect of Low-Temperature Plasma on Seed Germination and Growth of *Andrographis paniculata* (Burm.f.) Nees

Theerapat Thaweerat*
Kasetsart University, Bangkok, Thailand theerapat.tha@ku.th

Mayura Veerana Kasetsart University fscimuv@ku.ac.th

Andrographis paniculata (Burm.f.) Nees, also known as King of the Bitters, is a medicinal plant in the *Acanthaceae* family. This herb produces andrographolide, the main bioactive component with anti-inflammatory, antibacterial, and antiviral properties, which is obtained from mature plants grown normally from seeds. However, the main issue with growing this herb from seed is poor seed germination. In this study, we aim to enhance seed germination of *A. paniculate* using low-temperature plasma technology. Seeds were treated with micro dielectric barrier discharge plasma using air gas for 0, 2, 5, and 10 min, and seed germination and growth development were investigated. The results show that low-temperature plasma enhanced the seed germination percentage of *A. paniculate* by approximately 38% and 13% after plasma treatment for 2 and 5 min, respectively when compared with the control (0 min). Furthermore, low-temperature plasma had no effect on *A. paniculata* shoot and root length, plant biomass, and chlorophyll content. This finding suggests that low-temperature plasma has the potential to be used as an alternative technology for improving *A. paniculate* seed germination.

Keywords: *Andrographis paniculate*, Low-temperature plasma, Seed germination, Growth development

Analysis of Elemental Distribution in Biological Samples by Micro-XRF Spectrometer

Praeploy Boondam*
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand praeploy.b@ku.th

Wanwisa Sudprasert
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand fsciwasu@ku.ac.th

X-ray fluorescence (XRF) is a technique used to analyze the elemental composition of a sample without damaging it, making it a hassle-free method of sample preparation. Mapping XRF is a technique that allows for the study of the distribution of elements in biological samples. The aim of this study was to investigate the distribution of elements in pig intestines and compare the characteristics of homogeneous and non-homogeneous samples. To achieve this, the samples were divided into two groups: homogeneous and non-homogeneous. The homogeneous group was further divided into two sub-groups: un-spiked and spiked with a copper sulfate solution. The samples were analyzed using the M4 TORNADO XRF spectrometer, and the obtained data were compared to identify any differences in elemental distribution between the homogeneous and non-homogeneous samples. The effect of spiking with copper sulfate was evaluated by comparing the elemental distribution in the spiked and un-spiked sub-groups of the homogeneous group. The results showed that the elemental distribution in homogeneous and non-homogeneous samples differed significantly. This finding highlights the importance of considering sample homogeneity when studying elemental distribution. Moreover, the study demonstrated that the spiking of samples with copper sulfate had a noticeable effect on the elemental distribution of the spiked sub-group compared to the un-spiked sub-group. These findings have implications for further research and development in the biological sciences, particularly in the analysis of elemental distribution in biological samples.

Keywords: Biological samples, Elemental distribution, Micro-XRF spectrometer

Measurement of Radionuclides in Imported Sauce from Japan by Gamma Spectrometry with High Purity Germanium (HPGe) Detector

Poochit Chiawchan*
Kasetsart University, Bangkok, Thailand poochit.ch@ku.th

Paiboon Reungpatthanaphong Kasetsart University fscipbr@ku.ac.th

According to Japanese sauces, nowadays, they are more popular worldwide than the past due to easily accessibility and Japan's soft power. However, in year 2011, Japan experienced a severe earthquake and the tsunami waves which caused widespread death and hazardous radioactive materials were released to surrounding areas and the environment. This study aimed to measure and analyze the specific activity of ^{40}K, ^{131}I, ^{137}Cs and ^{235}U of six imported Japanese sauces, including instant concentrated soup for noodles, sauce for deep- fried pork, instant concentrated soup, sweet vegetable sauce, ponzu sauce, and tempura sauce. This six samples were measured and analyzed the specific activity of natural radionuclides using gamma spectrometry with a High Purity Germanium Detector (HPGe) at 21,600 seconds. The results showed that the specific activity of ^{40}K, ^{137}Cs and ^{235}U were detected. While ^{131}I could not be detected in all samples. The values of the specific radiation strength were range from 28.62-75.32 Bq/L, 0.44-0.47 Bq/L and 10.40-18.43 Bq/L in 40K, 137Cs and 235U, respectively. The data of this study were lower than the international standarts which were accepted by the International Atomic Energy Agency (IAEA). Therefore, all of imported Japanese sauces that were measured and analyzed in this study would be safe and as can be used food additives.

Keywords : Japanese sauce, Radioactivity, Gamma spectrometry, High purity germanium detector.

Effect of UV-C on growth and biochemical components of broccoli (*Brassica oleracea*) sprouts

Sirirat Keawrayb*
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand Sirirat.keaw@ku.th

Katarut Chutinanthakul
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand fscikac@ku.ac.th

Microgreens are young edible seedlings vegetables and herbs, such as sunflowers, red spinach, peas, and broccoli sprouts. They are a new alternative healthy food. Growing microgreens can be planted indoor and outdoor plan factory to control their growing conditions. There are many factors that was studied to improve their yields and quality Artificial lighting, such as ultraviolet radiation is one of them which can help improve the qualities of microgreens. This study aimed to study the effects of UV-C on the growth and biochemical components of broccoli (*Brassica oleracea*) sprouts. UV-C radiation was exposed to broccoli sprouts at 0, 1, 2, 3, and 4 minutes per day for 5 consecutive days. Analyzing shoot length, fresh biomass and some biochemical components consisted of chlorophyll, carotenoids, phenolic compounds, and flavonoids. The study found that the UV-C radiation influenced shoot length and fresh weight of broccoli sprouts, which tends to decrease with longer UV-C irradiation time. UV-C irradiation at 4 min had the highest effect on phenolic compounds. In conclusion, UV-C irradiation has effect on the growth of broccoli sprouts and effect some biochemical components. But had non-effect on Chlorophyll a, chlorophyll b, and carotenoid.

Keywords: UV-C radiation, broccoli sprout, *Brassica oleracea*, microgreens

Studies on Heavy Metal Adsorption of Natural Rubber Foam with Gamma-Irradiated Chitosan Powder

Thitiwan Intha*
Kasetsart University, Bangkok, Thailand Thitiwan.int@ku.th

Kiadtisak Saenboonruang Kasetsart University Kiadtisak.s@ku.th

In this study, gamma-irradiated chitosan powder is added to natural rubber foam to evaluate the absorption of heavy metals. conducting research and testing on the specimen with and without chitosan added at 9 parts per hundred parts of natural rubber weight (phr). In order to investigate the effect of gamma irradiation on the specimen's ability to adsorb heavy metals, two types of chitosan—one that has undergone gamma irradiation (60 kGy) and the other that has not—will be applied in the mixture with natural rubber latex. Irradiated chitosan's morphology and molecular weight were also investigated. Based on the results, deacetylation ranges from 84% to 85% after chitosan has been exposed to radiation dose of 60 kGy, as well as the initial molecular weight of 42.979 kDa tends to decrease to 33.152 kDa. The morphology of non-gamma-irradiated chitosan has a fibrous surface, but following the irradiation, the surface becomes more uniform with less roughness, possibly because of chain scission on glycosidic bond. In the heavy metal adsorption test, copper ion (Cu^{2+}) absorption was investigated in a solution with a concentration of 20 mg/l in 50 ml. Copper ions in the solution were reduced to 9.81, 2.30, and 1.77 mg/l, respectively, by submerging the specimen without the addition of chitosan in the solution for 48 hours, as well as specimens with non-irradiated and gamma-irradiated chitosan addition. The percentages of heavy metal absorption efficiency are 50.95, 88.25, and 91.15, respectively. It has been demonstrated that natural rubber foam can absorb heavy metals when gamma-irradiated chitosan powder is added with highest adsorption efficiency. Due to distribution of chitosan powder with low molecular weight.

Keyword : Heavy metals, Morphology, Molecular weight, Degradation, Chain scission

Influences of Samarium Oxide on Mechanical, Physical and Neutron Shielding Properties of 3D Printed Ceramics

Natthida Bangpradong*
Kasetsart University, Bangkok, Thailand natthida.ba@ku.th

Assoc. Prof. Dr. Kiadtisak Saenboonruang fscikssa@ku.ac.th

At present, neutron particles are widely used. Both medical, agricultural and industrial, etc., where neutron particles have the ability to move through any medium better than other types of radiation. It is important to consider the serious hazards to the health of those exposed to radiation. According to the ALARA (As Low As Reasonably Achievable) safety principles, the use of effective radiation shielding is especially important for workers who need to work in close proximity to the radiation source. This work is to study the influence of samarium oxide addition on Mechanical, Physical and Neutron Shielding Properties of 3D Printed Ceramics. By studying and testing the properties of ceramic materials and samarium oxide filler, the amount of 0, 1.09, 2.19, 3.30 wt%. Forming ceramic materials using a print with width x length equal to 5 x 10 cm. and with an average material thickness of 0.3 cm. According to the research results, samarium oxide was evenly distributed in the ceramic material. By adding more samarium oxide, the ceramic material becomes more porous but has less hardness. The density of ceramic materials increases with increasing amount of filler. The neutron shielding properties of ceramic materials with samarium oxide filler thickness from 3, 6, 9, 12, 15 mm showed that increasing the thickness of the ceramic material results in a decrease in the percentage of neutron transmission and from the minimum material thickness test, it was found that the half value layer of this ceramic material decreased with increasing amount of samarium oxide filler.

Keywords : Radiation Shielding, Neutrons, Samarium Oxide, 3-D Printing, Ceramics

Determination of heavy metals in pickled green mussel sauce at Samut Songkhram Province

Natthasurang Nampon*
Kasetsart University, Bangkok, Thailand Natthasurang.n@ku.th

Ridthee Meesat Kasetsart University fscirim@ku.ac.th

Heavy metals are often contaminated in seawater because of various human activities on the ground. Metals are non-biodegradable in nature and can be accumulated in the environment and transported through the food chain which causes risk to aquatic animals and consumers with high concentrations of heavy metals. Samut Songkhram province is a key source of seafood because its coastal fishery makes it economically important, especially pickled green mussels farming and pickled green mussels processing, one of the province's famous agricultural products. However, one of the major problems with pickled green mussels and their processed products was heavy metal contamination. The main purpose of this project is to quantitative analysis of heavy metal contamination in the sauce of pickled green mussel products by X-ray fluorescence method with standard additive techniques consisting of cadmium (Cd), lead (Pb) and zinc (Zn). The results of the cadmium (Cd) and lead (Pb) concentration was very low level and could not be detectable. However, the amount of zinc in the sauce was 70.34 part per million (ppm).

Keywords: Pickled green mussels, Cadmium (Cd), Lead (Pb), Zinc (Zn), X-ray fluorescence

Determination of antioxidant activities of extract mangosteen peel using DPPH assay and Fricke Dosimeters.

Pinita Boonkaew *
Kasetsart University, Bangkok, Thailand pinita.b@ku.th

Ridthee Meesat Kasetsart University fscirim@ku.ac.th

This nuclear science project investigated the antioxidant efficacy of mangosteen peel extract using two techniques, namely the DPPH assay technique and radiation chemical Fricke dosimeters. The basic principle was based on the reaction of DPPH, a synthetic radical, with antioxidant compounds that could transfer electrons and hydrogen radicals. In the other hand, the irradiation of chemical dosimeter results from the formation of radiolytic species which is radicals and molecular species. Thus, techniques could be applied to measure the antioxidant activity of interesting compounds. In Fricke solutions, the Fe^{3+} resulted from reaction between Fe^{2+} and water radiolytic species. The yield of Fe^{3+} depended on the radiation absorbed dose. If adding antioxidants in the radiation chemical systems, the antioxidant compound from extracted mangosteen peel competed with Fe^{2+} to react with radical and molecular species. The concentration of Fe3+ will decrease as a function of concentration of antioxidant compounds increase.

Therefore, this project was interested in studying the measurement of mangosteen peel extract for antioxidant efficacy using DPPH assay and Fricke dosimeters. The extract mangosteen peel composted of antioxidant compounds that could react with free radicals from DPPH assay and radiation dosimeter method. The results showed that mangosteen peel extract indicated antioxidant properties. In the case of DPPH assay, the half maximal effective concentration (EC50) of extracted compound was 0.16 ± 0.02 ppm. The antioxidant activity of extract compounds from mangosteen peels was measured by Fricke dosimeter techniques and showed yield of Fe^{3+} (G(Fe3+)) decreasing as a function of concentration of extracted mangosteen solutions.

Keyword : DPPH+ technique, Fricke dosimeter, radiolysis, radiolytic species, Fe2+, Fe3+, UV spectrophotometer

Qualitative and Quantitative Elemental Analysis of Coffee Beans by Energy Dispersive X-Ray Fluorescence Technique

Molthita Khongram*
Kasetsart University ,Bangkok ,Thailand molthita.k@live.ku.th

Pakorn Tangpong Kasetsart University pakorn.tan@live.ku.th

This study aimed to evaluate the type and quantity of trace elements in coffee beans using energy-dispersive X-ray fluorescence (EDXRF). Nine coffee bean samples were analyzed, including five Arabica and four Robusta coffee samples. The results revealed that coffee beans accumulate significant amounts of primary constituents such as potassium, phosphorus, magnesium, sulfur, and calcium, with potassium being the most abundant element at 98% of the total concentration. The study also identified secondary constituents, including magnesium, iron, zinc, and rubidium. Arabica coffee tends to accumulate trace elements, although significant elements such as potassium and phosphorus were found in smaller amounts than in Robusta. Conversely, Robusta coffee accumulates fewer manganese trace elements than Arabica coffee. In addition, coffee from the southern region had a higher accumulation of elemental chlorine than other sources.
These findings provide essential insights into the elemental composition of coffee, which could have significant implications for coffee quality and health benefits.

Keywords : Elemental analysis , Coffee beans , Energy dispersive x-ray fluorescence technique

Quantitative analysis of selected heavy metals in seawater of Samut Songkhram coastal area

Rinwarang Moolthep*
Kasetsart University, Bangkok, Thailand rinwarang.m@ku.th

Prof. Ridthee Meesat Kasetsart University fscirim@ku.ac.th

Human activities can increase contamination of heavy metals in the environment and can effect on natural resources and agriculture especially coastal regions, having access to the sea. This project is interested to measure heavy metal contamination in sea water in the coastal area of Samut Songkhram Province because there are a lot of coastal fishing and source of seafood that is famous of the province. Heavy metals composed of cadmium, lead and mercury were analyzed by micro x-ray fluorescent (micro-XRF) using standard addition technique. Seawater samples were collected and added 1M nitric acid and sulfuric acid to digest organic matters. The micro-XRF technique could be used to qualitative and quantitative analysis. the results showed that the water samples contained 2.3 ppm lead and 0.12 ppm mercury, but no cadmium was found in the seawater samples.

Keywords: heavy metal, X-ray fluorescence, seawater.

Determination of elements in shells of green mussels by Microbeam X-ray fluorescence

Warisara Srisan*
Kasetsart University, Bangkok, Thailand warisara.sri@ku.th

Assistant prof. Dr. Ridthee Meesat Kasetsart University fscirim@ku.ac.th

This project is to study the determination of elements in green mussel shells by microbeam X-ray fluorescence. The six green mussel shell specimens from Samut Songkhram were analyzed composition elements in the shells. The results showed that shells of green mussels composted of several elements, namely calcium (Ca) up to 97%, which is the main element in the shells, strontium (Sr), boron (Br), iron (Fe) and manganese (Mn). In addition, we also discovered that in shells of green mussels' samples there was an accumulation of heavy metal elements, cadmium (Cd), which is found at ~0.12 percent by mass.

Keywords: Shells of green mussels, Microbeam X-ray fluorescence, Heavy metal, Determination of elements

Antioxidant Activity and Radioprotective Effect of Cardamom seed (*Amomum cardamomum* L.) and Khao Hawm Mae Paya Tong Dam Black Rice (*Oryza sativa* L.) Extract

Kanokwan Luansri and Paiboon Reungpatthanaphong
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand
E-mail: kanokwan.lua@ku.ac.th , fscipbr@ku.ac.th

Gamma rays from many different sources cause free radicals that damage human cells. Previous studies reported antioxidant activity of Thai herbs which have been commonly used as traditional medicine, foods, beverages, and cosmeceutical products. This study aimed to determine antioxidant activity and radioprotective effect of the extraction from Cardamom seed (*Amomum* cardamomum L.) and Khao Hawm Mae Paya Tong Dam Black Rice (*Oryza sativa* L.). The crude extracts were determined antioxidant activity by DPPH and ABTS radical scavenging activities, total phenolic content by Folin-Ciocalteu method and radioprotective effect in TK6 cell by MTT assay. The strongest antioxidant activity were found in the extract from Cardamom seed based on DPPH and ABTS assay (EC_{50} = 573.68 ± 1.55 µg/ml and 347.86 ± 0.75 µg/ml, respectively). Moreover, Cardamom seed contained the highest amount of total phenolic content (21.000 ± 0.004 mg GAE/ g of extract) which might represent its antioxidant property. However, Khao Hawm Mae Paya Tong Dam Black Rice exhibited its potential to protect gamma rays induced cell damage in TK6 cell. In conclusion, preclinical studies should be performed to confirm efficacy and toxicity of these extracts.

Keywords: Antioxidant activity, Radioprotective effect, Total Phenolic Content, Cardamom seed (*Amomum cardamomum* L.), Khao Hawm Mae Paya Tong Dam Black Rice (*Oryza sativa* L.).

Effects of water deficit on growth and chlorophyll content of Cordyline *in vitro* seedling

Tartchayar Mahaphattrapun*
Kasetsart University, Bangkok, Thailand tartchayar.s@ku.th

Katarut Chutinanthakun Kasetsart University fscikac@ku.ac.th

As climate changes increase, drought stress is becoming a problem for all major crops and cut foliage, causing plants to lose more water from the soil and plants. Polyethylene glycol 6000 (PEG) have been long used to simulate drought stress in plants as non-penetrating osmotic agents lowering the water potential in a way similar to soil drying. *In vitro* culture techniques minimize environmental variations combining to gamma ray mutagenesis provided potential for crop improvement. This study aimed to evaluate plant growth and chlorophyll content of Cordyline *in vitro* seedling under drought stress. Cordyline seedling were treated using gamma radiation (0 and 40 Gy) and subcultured in MS medium until reaching the M1V7 generation. Unirradiated and irradiated treatments were grown under MS medium which added 0, 1, 2 %(w/v) of PEG 6000. Plant growth were recorded in two months. Chlorophyll and MDA (product of lipid peroxidation) contents were determined and statistically analyzed for significant differences. The results showed that PEG 6000 induced a negative effect on the unirradiated Cordyline *in vitro* seedling growth of which 2%(w/v) of PEG 6000 demonstrated significant different lower than control. Chlorophyll content were decreased whereas MDA content were increased with increasing PEG 6000 concentration. Three M1V7 irradiated lines revealed high growth rate at 2%(w/v) of PEG 6000 along with MDA content accumulated lower than control. Using gamma radiation at dose of 40 Gy induced genetic variation of Cordyline population had potential for selecting drought tolerance lines under *in vitro* condition.

Keywords: Cordyline, Drought, Polyethylene glycol, *In vitro*.

Elemental Analysis of PM 2.5 Using a Micro-XRF Spectrometer

Thanyaporn Duangpila*
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand Thanyaporn.duan@ku.th

Wanwisa Sudprasert
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand fsciwasu@ku.ac.th

PM2.5 refers to particulate matter that is less than 2.5 micrometers in diameter and is categorized as the most harmful pollutant among general air pollutants. Long-term exposure to PM2.5 can cause serious health effects. Currently, PM2.5 is the most serious air pollution problem in Thailand. The chemical composition of PM2.5 has a wide range of origins depending on many factors, making it difficult to identify and verify the source. The purpose of this research was to analyze the distribution of PM2.5 constituents occurring in Bangkok and its vicinity in order to assess the possible sources. Samples were taken for 24 hours in Bangkok, Samut Prakan and Samut Sakhon. The elemental composition of PM 2.5 was analyzed by micro-XRF M4 TORNADO using X-rays to induce atomic energy in the sample and study the elemental distribution in the sample by XRF mapping. The results showed that PM2.5 from Bangkok, Samut Prakan and Samut Sakhon provinces mainly consisted of S, followed by K and Zn, respectively. They also contained small amounts of other elements such as Si, Fe, Ca, Al and P. The main origin of these elements may be related to road dust and pollution from vehicles.

Keywords: PM2.5, Element distribution, X-Ray Fluorescence Spectrometry

Risk assessment from environmental radiation exposure around the Center for Radiation Ecology

Panalee Yuttananukul[1], Chanis Rattanapongs [2]

Department of Applied Radiation and Isotope, Faculty of Science, Kasetsart University, Bangkok Thailand
E-mail: panalee.y@ku.th , fscicnp@ku.ac.th

This research focuses on radiation dose monitoring. that may contaminate in environment around the Center for Radiation Ecology. From radiation activity including measuring the background radiation of the area. Generally, radiation can be found anywhere. whether it is the earth's crust, air, water sources, ground, vegetation in the atmosphere including outside the atmosphere and when it enters the body, it interacts with the tissues The radiation causes ionization and is absorbed in the macromolecules within cells (e.g., DNA, RNA, proteins, enzymes, etc.) make the structure of macromolecules malfunction and result in DNA defects and cannot avoid exposure to radiation in daily life.Therefore, in order not to allow personnel and those involved in the area to receive radiation dose from activities in the area exceeding the safe limits specified by the ICRP. The researcher has monitored the radiation dose. with gamma spectrometric method to measure gamma radiation in the Center Radiation Ecology.In addition, the values were used to assess the effective dose per year to confirm the safety values. and radiation dose monitoring by gamma spectrometry, it was found that the radiation dose was not more than *1* mSv/year, which was at an acceptable level for radiation protection work.

Keywords: gamma spectrometry, effective dose, radiation protection

Antioxidant Activity and Radioprotective Effect of Chamomiles tea

Pemika Sriyam and Paiboon Reungpatthanaphong
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand
E-mail: pemika.sriy@ku.ac.th, fscipbr@ku.ac.th

Chamomile (*Matricaria chamomilla*) has been used as healthy tea due to its pharmacological actions. This study aimed to determine the antioxidant activity and radioprotective effect of chamomile tea in *in vitro* study. Water extraction at 100 °C of chamomiles at various times (2, 30, and 60 minutes) was used to determine antioxidant activity by using the DPPH and ABTS assays. In addition, Total Phenolic content (TPC) was measured. The results demonstrated that the water extracted of chamomiles for 30 minutes showed the highest antioxidant activities in the DPPH and ABTS assays (EC_{50} values of 245.00 ± 2.59 µg/ml and 125.00 ± 1.64, respectively) when compared to the water extracted for 60 minutes (EC_{50} values of 292.50 ± 1.28 µg/ml and 138.00 ± 2.35 µg/ml, respectively) and the water extracted for 2 minutes (EC_{50} values of 480.00 ± 2.57 µg/ml and 139.00 ± 0.36 µg/ml, respectively). Total phenolic content of chamomile tea at 30 minutes showed the highest value (72.80 ± 0.07 mg GAE/g of sample extract). The radioprotective effect of chamomiles tea on human lymphocytes (TK6 cell) was determined by MTT assay. It was found that the radioprotective effect was measured with higher concentration. In conclusion, chamomile tea may have antioxidant and radioprotective effect on human lymphocytes by preventing radiation-induced cell death in dose-response relationship.

Keywords: Chamomiles tea, Antioxidant activity, Radioprotective effect, Total phenolic content

Effects of gamma irradiated chitosan on antibacterial properties of natural rubber latex gloves

Ploychompu Chairoekthawin*
Kasetsart University, Bangkok, Thailand ploychompu.ch@live.ku.th

Kiadtisak Saenboonruang Kasetsart University fscikssa@ku.ac.th

Chitosan is a polysaccharide that is a derivative of chitin from the acetyl group in chitin to glucosamine from deacetylation reactions. It has an inhibitory effect on the growth of bacteria as an interference on the surface of negatively charged bacteria, it causes a leakage of nutrients or covers the cell surface, preventing nutrients from entering the cell. Therefore, this project is interested in studying the effect of adding 30 kGy gamma-irradiated chitosan powder that effectively inhibits bacteria in latex gloves. Start by applying 1000 grams of gamma-irradiated chitosan solution into a ball mill grinder to mix with the calculated chemical. It is mixed with natural latex with a 60% thickening capacity and chemicals used to form latex gloves according to the formula at the volumes of 0, 4, 8, and 12 parts per hundred parts of rubber weight (phr). After that, cut the rubber gloves into circles to form a line through the 4.5mm central formula. Tested for bacterial inhibition using 3 types of bacteria with different properties. The results of the study concluded that chitosan can inhibit bacteria, but its effectiveness also depends on the amount and intensity of the chemicals used to form rubber gloves. And because the chitosan we use is less concentrated, its effectiveness in inhibiting bacteria decreases.

Keywords: Natural rubber, Chitosan, Gamma ray, Antibacteria

Effects of Cold Plasma on Seed Germination and Growth of Khao Dawk Mali 105 Rice

Mingkamon Authensut*
Kasetsart University, Bangkok, Thailand mingkamon.a@ku.th

Mayura Veerana Kasetsart University fscimuv@ku.ac.th

Rice (*Oryza sativa*) is an essential staple food for at least half of the world's population. Thailand is one of the countries with the 5th largest rice growing area globally and the 2nd largest in Southeast Asia. At present, the effects of climate change are threatening rice cultivation systems. Therefore, this study aims to improve the seed germination and growth development of Jasmine rice (Khao Dawk Mali 105; KDML105) using cold plasma technology. Rice seeds were treated with micro dielectric barrier discharge plasma using air gas for 0, 2, 5, and 10 min, and seed germination and growth development were analyzed. The results show that cold plasma had no effect on KDML105 rice seed germination. Interestingly, the shoot length was significantly increased after plasma treatment at 2 and 5 min, and the root number and plant biomass were significantly heightened after plasma treatment at 2, 5, and 10 min when compared with the control (0 min). This finding suggests that cold plasma could be used as an alternative method for improving the growth development of KDML105 rice.

Keywords: Cold plasma, Khao Dawk Mali 105 Rice, Seed germination, Growth development

Effects of UV-C on the growth and phenolic content of pea sprouts (*Pisum sativum*)

Areeya Jitmontree*
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand areeya.ji@ku.th

Katarut Chutinanthakun
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand fscikac@ku.ac.th

The trend of plant based protein turn people's attention to eat more vegetables. Microgreens are young vegetable that contain higher nutrient levels. Pea sprouts is one of the most commonly consumed microgreens. UV-C light is influences the physiology of plants, biochemical compounds and nutritional value of plants. In this study, we investigated the effects of UV-C radiation on growth and some biochemical compounds of pea sprouts. UV-C exposed for 0, 1, 2, 3 and 4 minutes on the 3^{th} , 6^{th}, 9^{th} and 12^{th} days. Shoot length, fresh weight and biochemical compound were recorded. The results showed that pea sprouts exposed to UV-C radiation for 3 minutes accumulated phenolic content significantly higher than control. Shoot length and fresh weight decreased when exposured time increased and revealed significantly lower than control on 2-4 minutes. However, 0-4 min irradiation had no effect on Chlorophyll a, Chlorophyll b and Carotenoid contents. UV-C exposured for 3 min is the optimum time to stimulate the phenolic content in pea sprouts.

Keywords: UV-C radiation, pea sprouts, *Pisum sativum*, phenolic, antioxidant

Qualitative element analysis in Nam Wa Banana Powder using X-ray fluorescence technique

Kawintira Bootsen*
Kasetsart University, Bangkok, Thailand kawintira.b@ku.th

Ridthee Meesat Kasetsart University fscirim@ku.ac.th

Nam Wa Bananas are a food source that contains carbohydrates, protein, vitamin A, vitamin B6, vitamin B12, vitamin C and minerals, magnesium (Mg), zinc (Zn), iron (Fe), phosphorus (P), and potassium (K). Nowadays, Nam Wa banana powder is processed for food and promotes health. There are many claims of medicinal properties of the banana product. This study is interested in studying the qualitative elemental analysis of Nam Wa banana powder samples using the X-ray fluorescence technique. This technique can be applied to qualitative and quantitative elemental analysis. The qualitative analysis was used to determine element distribution in Nam Wa banana powder. X-ray fluorescence was examined for trace elements in Nam Wa banana powder three samples. The results showed that all of powder samples had the same elements, namely potassium (K), which was the most common element. There were some elements detected, namely chlorine (Cl), magnesium (Mg), phosphorus (P), and sulfur (S). In addition, some heavy elements were found in these samples, manganese (Mn), rubidium (Rb), zinc (Zn), strontium (Sr), and copper (Cu) were found to decompose slowly and tend to contaminate in various environments.

Keywords: Nam Wa Banana powder, X-ray fluorescence technique, Testing for trace elements

Measurement of the Potassium-40 in coffee beans by Gamma spectrometry using a High-Purity Germanium detector (HPGe)

Chanwit Pratumwit[1] and Pakorn Tangpong[1*]
[1]Department of Applied Radiation and Isotopes, Kasetsart University, Thailand
[*]Corresponding author

The topography and climate of the study area are suitable for growing Arabica and Robusta coffee trees, with variations between the species. This project aims to measure the amount of naturally occurring potassium-40 (0.012% of total potassium content found in nature) in coffee beans using gamma spectrometry with a High-Purity Germanium detector (HPGe). The experimental method was involved grinding the coffee beans into a homogeneous sample, weighing it, calibrating the detector, and creating a calibration curve to measure the potassium-40 content at 1460.82 keV for 12 hours. The results showed that all samples contained potassium-40 at 1460.82 keV energy, with values ranging from 246.27 Bq/kg in sample A2 to 552.00 Bq/kg in sample A4, which fall within acceptable limits. Additionally, some samples contained Th-227, Th-234, U-235, In-116, Pb-210, Pb-214, Ac-228, Bi-214, and Ir-192 as radionuclides. These findings provide important information about the radioactivity levels of coffee beans, which can inform health and safety guidelines for consumers.

Keywords: Coffee beans, Potassium-40, Gamma spectrometry, HPGe, Radioactivity levels

Effect of Gadolinium Oxide on Mechanical and Neutron Shielding Properties of Ceramic Materials Prepared with 3D Printing Technology

Nalinnipa Sangsud*
Kasetsart University, Bangkok, Thailand nalinnipa.san@ku.th

Kiadtisak Saenboonruang Kasetsart University fscikssa@ku.ac.th

This research is study effect of Gadolinium oxide Addition on Mechanical Properties and Neutron-Shielding Properties of Ceramic Materials prepared with 3D Printing Technology. Conducting studies and testing of ceramic materials containing varying gadolinium oxide fillers at 0, 1.09, 2.15 and 3.19 wt.% affected the Mechanical properties, Morphology and including the Neutron-Shielding Properties of ceramic materials, which use molding processes to test the optimal ratio and develop formulations before being used with a 3D printer. The results showed that the mechanical properties of ceramic materials with the addition of gadolinium oxide fillers tend to decrease with increasing fillers content. Morphological testing was found that the gadolinium particles distributed relatively evenly, the result showed that an increased the density of ceramic materials as well, and when increasing fillers content the result showed that an increased voids and cracks between the surfaces. In terms of Neutron-Shielding Properties was found that at a filler content of 3.19 wt.% at 15 mm thickness had the highest shielding efficiency for neutron particles.

Keywords: Gadolinium Oxide, Neutron-shielding material, Ceramic, 3D Printing

Calibration Curves for Absorbed Dose of 120 kV X-Rays using Alanine/EPR Dosimeter

Nattawut Yooyen*
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand nattawut.yoo@ku.th

Pongphanot Rindhatayathon
Office Atoms for Peace, Bangkok, Thailand pongpanot.r@oap.go.th

Wanwisa Sudprasert
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand fsciwasu@ku.ac.th

Alanine/EPR dosimeters offer a promising alternative to standard dosimeters, such as solid-state detectors and gas ionization chambers, in the fields of radiotherapy and diagnostic radiology. This dosimetry system presents several advantages, including its small size, sensitivity to radiation, and low signal fading rate after irradiation. The aim of this project was to investigate the response of alanine to 120 kV X-rays in the dose range of 0-18 Gy and to establish calibration curves for absorbed dose of X-rays using an alanine/EPR dosimeter. To achieve this, alanine pellets were irradiated with 120 kV X-rays, and 5 pellets were used for each radiation dose. The EPR signal intensity was measured using an electron spin resonance spectrometer, and the obtained values were used to establish the calibration curves for absorbed dose. The results indicated that alanine had a linear response to 120 kV X-rays within the range of 0-18 Gy, with a relative equation between EPR signal (y) and absorbed dose (x) of $y = 11.982x + 32.955$ ($R^2 = 0.9801$). Furthermore, the alanine pellets showed a very low percentage of fading when kept for 7 or 15 days after X-ray irradiation. These findings can serve as a basis for further measurements of absorbed dose using an alanine/EPR dosimeter at the Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University. They can also be useful in estimating the absorbed dose from X-rays in radiotherapy and diagnostic radiology.

Keywords: Absorbed dose, X-rays, Alanine/EPR dosimeter, Calibration curves

Determination of elements in green mussels tissue by Microbeam X-ray fluorescence.

Patomporn Khiaoaram
Kasetsart University, Bangkok, Thailand patomporn.k@ku.th

Ridthee Meesat Kasetsart University fscirim@ku.ac.th

Green mussel is an economically important aquatic resource of Samutsongkhram province. Currently, the popularity of consumption causing the shellfish culture industry to expand more, resulting in changes in the hydrological nature physical structure as well as the distribution patterns of minerals and suspended sediments within the estuary ecosystems. One of the important issues of green mussel is heavy metals contamination. Therefore, this project focused on element distribution analysis in green mussels *(Perna viridis)* in both males and females were collected from coastal zone of Samutsongkhram. The bivalve-shell samples were analyzed by microbeam x-ray fluorescence scanning technique to track elements accumulated in various organs and parts within the specimen tissues. The results found that some element distribution in the sample tissues for example potassium , manganese , iron , phosphorus , etc. In case of female green-mussel tissues, the accumulation of some metals was much more than male tissues. In addition, the toxic heavy elements were not detected in the mussel's tissues. Meanwhile, the main elements in male mussel tissues were sodium and magnesium.

Keywords: Green mussels tissue , Samutsongkhram , Elements.

Determination of the antioxidant activity of extracted solutions from mangosteen peel using radiation chemical Fricke Dosimeters

Pattiya Srisujarit*
Kasetsart University, Bangkok, Thailand pattiya.sr@ku.th

Ridthee Meesat Kasetsart University fscirim@ku.ac.th

Mangosteen peel extract has many pharmaceutical effects, such as anti-inflammatory effects, analgesic effects, antibacterial effects, etc. In the case of the effect of antioxidant properties, It is due to the fact that the mangosteen peel extract contains high xanthones. The purpose of this study was to study the determination of the antioxidant activity of extracted solutions from mangosteen peel using radiation chemical Fricke dosimeters. The chemical dosimeter based on competition between Fe^{2+} and extracted compounds to react with radical species from gamma radiolysis. This method used gamma radiation to generate free radicals and measured yields of Fe^{3+} using a UV-vis spectrophotometer. The antioxidant activities resulted from the comparison of the control set without mangosteen peel extract and the sample set containing mangosteen peel extract after gamma-ray irradiation at different times. The results show the mangosteen peel extract could inhibit free radical formations after irradiation.

Keywords: Mangosteen peel extract, Antioxidants, Free radical, Radiation chemical, Fricke dosimeter, Gamma-ray, UV-Vis spectrophotometer

The ability of antioxidant substances in Thai coffee beans to eliminate free radicals with DPPH Assay

Panupong Kovitanupong*
Kasetsart University, Bangkok, Thailand panupong.kov@ku.th

Pakorn Tongpong Kasetsaart University fscipota@ku.ac.th

This nuclear science project investigates the antioxidant efficacy of Coffee extracts in Thailand were studied in 8 areas in the northern, southern and eastern regions by using the DPPH Assay technique. The basic principle is that when 2,2-diphenyl-1-picrylhydrazyl (DPPH) is a stable radical, it is purple and absorbed. Light well at wavelength 515-517 nm interacts with antioxidants in coffee extract. By obtaining hydrogen from antioxidants in coffee extract, DPPH-H with a clear color was obtained. The results showed that coffee extract in Thailand had antioxidant properties in all 8 areas by the light absorbance correlation. And the sample concentration showed promising results. It has been shown that coffee extract in Thailand is effective in scavenging antioxidants. It was also found that coffee extracts in northern Thailand had better antioxidant efficacy than other regions. The most effective sample had a %EC50 of 1067 ug/ml, indicating that coffee extract in northern Thailand has a good antioxidant scavenging efficiency.

Keyword: DPPH, Stable Radical, Absorbance, %EC50

Calibration Curves of Absorbed Dose to Water for 1-10 Gy Gamma Radiation using Alanine/EPR Dosimeter

Supissara Chancherngphanich*
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand supissara.c@ku.th

Pongphanot Rindhatayathon
Office of Atoms for Peace, Bangkok, Thailand. pongpanot.r@oap.go.th

Wanwisa Sudprasert
Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok, Thailand fsciwasu@ku.ac.th

Radiation is increasingly used in medicine, particularly for radiotherapy using gamma rays from cobalt-60 sources and high-energy X-rays from particle accelerators. Accurate measurement of radiation dose is crucial for optimizing treatment efficacy while minimizing patient exposure. The radiation dose can be determined by measuring the absorbed radiation dose in water using a tissue-like material such as alanine and analyze it with electron paramagnetic resonance (EPR) spectroscopy. This study aimed to investigate the radiation response of alanine and create dose-response calibration curves for gamma rays in the 1-10 Gy range used for radiotherapy. Alanine samples were irradiated with gamma rays from a cobalt-60 source at doses of 1, 2, 5, 8, and 10 Gy, and the free radicals generated were analyzed by EPR spectroscopy. The results indicate that alanine demonstrates a linear radiation response across the dose range, with the EPR signal intensity increasing proportionally with the dose. The relationship between absorbed dose and EPR signal intensity is described by the equation $y = 17.342 x + 16.501$ ($R^2 = 0.998$), where x represents the radiation dose in Gy and y represents the EPR signal intensity. The calibration curves, validated using blinded alanine doses ranging from 1 to 10 Gy, revealed only a 2% discrepancy in the dose readings. These findings provide a foundation for developing an alanine/EPR dosimeter system for use in a variety of applications by the Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University.

Keywords: Gamma rays, Radiation therapy, Absorbed dose, Alanine/EPR dosimeter

Evaluation of the antimalarial activities of nanoparticles against *Plasmodium falciparum*

Chonlathid Junrung*
Kasetsart University, Bangkok, Thailand chonlathid.j@live.ku.th

Paviga Limudomporn Kasetsart University fscipil@ku.ac.th

Pramote Chumnanpuen Kasetsart University pramote.c@ku.th

Malaria is an infectious disease caused by protozoan parasites *Plasmodium* sp. which carried by *Anopheles* mosquitoes and claims more than 400,000 lives each year. This epidemic mostly found in the tropical regions such as Thailand where are biological friendly for the mosquito. Although the current preclinical studying a various antimalarial drugs were developed, the pathogen has become more drugs resistance to medicine. Moreover, the drug has some limitations, such as dangerous side effect for the long term using and only effective for the certain strains especially *Plasmodium falciaparum*. This species is dominant in Thailand, causing a serious disease with the most fatalities and highly resistant to several antimalarial drugs.

Nanotechnology has been such promising for medicinal agent development and some of nanoparticles have an efficient antimicrobial property. Therefore, we aim to evaluate the efficacy to inhibit *Plasmodium falciparum* of 5 different nanoparticles i.e., ZnO, ZnOAg, ZnOEr, ZnOAgEr, and AgEr. According to the experimental results, only 3 types of nanoparticles (ZnAg, ZnO, and ZnOEr) showed the antimalarial ability to inhibit parasite growth rate of *Plasmodium falciparum* in the erythrocyte stage. Among all nanoparticles, ZnOAg has the highest inhibitory effect with the half-maximal inhibitory concentration (IC_{50}) of 25 µg/mL. For other nanoparticles, the percentage of inhibition in *Plasmodium falciparum* growth rate was relatively low. Therefore, more experimental analyses on other *Plasmodium* species in different stages of life cycle are required for further investigations.

Keywords: Nanoparticles; Nanotechnology; *Plasmodium falciparum*; Antimalarial, Antimicrobial

Betanin's effect on glycemic control and liver's glycogen in mice with trimethyltin-induced toxicity

Kanlayawadee Srisoonthon*
Kasetsart University, Bangkok, Thailand Kanlayawadee.s@ku.th

Wachiryah Thong-asa Kasetsart University fsciwyth@ku.ac.th

Betanin, an amino acid with high antioxidant activity. It has anti-diabetic property, lowers blood sugar and helps reduce elevated blood lipid levels. The present study investigated betanin's effect on glycemic control, liver's pathology and glycogen in mice with trimethyltin-induced toxicity. Thirty male ICR mice were divided into (1) Sham-veh, injection and oral administration with normal saline, (2) TMT-veh, injection with 1 mg/kg trimethyltin (TMT) and oral administration with normal saline, and (3) TMT-Bet100, injection with 1 mg/kg TMT and oral administration with betanin 100 mg/kg. One times TMT injection was followed by continuously oral administration for 3 weeks. The oral glucose tolerance test (OGTT) was taken once a week. After 4 weeks, liver tissue was collected and determination of pathology and glycogen was done by using H&E and PAS staining techniques, respectively. The results showed that TMT not significantly induced the impairment of glycemic control mechanism, however, mice that received betanin show significant reduction of blood glucose in OGTT when compared to other groups. Betanin also prevent the reduction of liver's glycogen induced by TMT. Betanin exhibited significant prevention of inflammation and ballooning of liver's cells. The present study concluded that betanin enhance glycemic control mechanism with prevention of glycogen reduction and amelioration of inflammation and ballooning of liver's cells.

Keywords: Betanin; Trimethyltin; Inflammation; Liver's glycogen; Blood glucose level

Rediscovery and redescription of *Grandidierella gravipes* (Aoridae: Amphipoda) in the Gulf of Thailand with a note on the distribution of amphipod genus *Grandidierella* in Amphawa Estuary, Samut Songkhram Province

Kijjar Saneewongnaayuthaya
Kasetsart University, Bangkok, Thailand kijjar.s@live.ku.th

Koraon Wongkamhaeng Kasetsart University fscikaw@ku.ac.th

Grandidierella gravipes K.H. Barnard, 1935 was first collected in 1925 from Songkhla Lagoon and was identified as *Grandidierella magnae*. After ten years, the specimens were identified as a new species and named *Grandidierella gravipes.* The amphipod was reported once in India but has not been reported in Thai Waters since the first sampling in 1925. In this study, the *Grandidierella gravipes* was found living together with *Grandidierella gilesi.* The amphipods were collected by Ekman grab and 7 types of settlement plates during March-October. The number of both species were highest in March, which *Grandidierella gilesi* is higher than *Grandidierella gravipes*. Both species showed a preference for fine filter. We provide a redescription of newly collected material with the illustration and the key to species of the *Grandidierella* in Thailand.

Keywords: Amphipod ; Distribution ; Amphawa ; *Grandidierella* ; Thailand

Effect of soil moisture on leaf structural and functional adaptation of tree seedlings.

Pichayapa Sangtien* Kasetsart University, Bangkok, Thailand pichayapa.san@ku.th

Kanin Rungwattana Kasetsart University kanin.run@ku.th

Athipat Ngernmuen Kasetsart University athipat.ng@ku.th

Soil moisture has a significant effect on plant development. Better adaptability of plants to drought can increase their survival. The structural adaptation is one of many features of adaptations which enable plant to survive. This study aimed to examine leaf structural and functional adaptations of tree seedlings and to compare these aspects between deciduous and evergreen tree seedlings under different amount of soil moisture. Planting 11 species of the economic tree seedlings was carried out in greenhouse. For each species, the experimental design had three treatments: (1) control; (2) moderate; (3) severe drought condition. The experiment was carried out with five replications. When seedlings aged 16 months, leaves were collected to examine their anatomy and compared their anatomical traits among species, treatments, and phenology. Our result found that the area percentage of the epidermis in the deciduous was significantly higher than evergreen in all treatments, but there was not significantly different in the area percentage of the palisade mesophyll between deciduous and evergreen in all treatments. While the area percentage of spongy mesophyll in moderate and severe treatments of the evergreen were higher than deciduous. The results demonstrate that the deciduous tree developed thick epidermis layer to prevent water loss from their leaves. For example, Copper pod (Peltophorum pterocarpum) grown in moderate and severe treatments performed thicker epidermis than control. The percentage of palisade mesophyll of Siamese neem tree (Azadirachta indica) performed the highest percentage in control treatment while the percentage of palisade mesophyll of Rosewood (Dalbergia cochinchinenis Pierre) and Tamarind (Tamarindus indica L.) was highest in moderate treatment. This study concluded that there was the difference in leaf structural adaptations in different soil moisture levels between the deciduous and evergreen trees.

Keywords: Deciduous; Evergreen; Leaf structural adaptation; Soil moisture; Tree seedling

The Effect of Ellagic Acid on Corpus Callosum, Internal Capsule, and Optic Tract in Mice with Chronic Cerebral Hypoperfusion

Panisa Thanyalakmara*
Kasetsart University, Bangkok, Thailand Panisa.than@ku.th

Wachiryah Thong-asa Kasetsart University fsciwyth@ku.ac.th

Chronic cerebral hypoperfusion (CCH) is a chronically decreased blood flow to the brain by obstruction or narrowing of blood arteries, which blocking nerve cells from receiving enough oxygen and energy that need to maintain normal neuronal function and led to neuronal and white matter damage. Therefore, this study aimed to investigate the effect of ellagic acid on the corpus callosum, internal capsule, and optic tract damage in mice with chronic cerebral hypoperfusion. Thirty-male ICR mice have randomly divided into 3 groups: Sham-veh groups received only surgery without arterial occlusion. UCO-veh groups received permanently right common carotid artery occlusion surgery, and UCO-Ell100 groups received permanently right common carotid artery occlusion surgery and received 100 mg/kg of ellagic acid via oral administration, continued for 2 weeks. White matter density i.e., corpus callosum (CC) internal capsule (IC), and optic tract (Opt.) were evaluated using Luxol fast blue staining. Our data showed that CCH significantly reduced white matter density in CC, IC, and Opt. when compared UCO-veh to Sham-veh ($p<0.05$). Treatment with ellagic acid significantly prevent the reduction of white matter density in IC and Opt. when compared UCO-Ell100 to UCO-veh ($p<0.05$). Therefore, this study indicated neuroprotective effect of ellagic acid against white matter damage in mice with chronic cerebral hypoperfusion.

Keywords: Right common carotid artery occlusion, Ellagic acid, Corpus callosum, Internal capsule, Optic tract**.**

Effect of Sang yod rice extract on MDA- MB231 breast cancer cell line development

Chadaphorn Kamsingwong*
Department of Zoology, Kasetsart University, Bangkok, Thailand Chadaporn.kam@live.ku.th

Mongkol Pongsuchart Kasetsart University mongkol.pon@ku.th

In Phatthalung Province, locally grown rice is called "Sang Yod rice" is an outstanding local rice in southern Thailand. It stands out in the situation as it has more health benefits and nutrition compared to normal rice. Sang yod red rice series is especially recommended because it contains anthocyanin, which has antioxidant properties that can fight cancer. And also high in vitamin E that can slow down the aging of body cells as well. Because of the mechanism of action of MDA-MB 231 breast cancer, which is the most aggressive type of Triple-Negative Breast Cancer (TNBC), compared to other types. Although the way to treat this type of cancer has progressed a lot. However, in the treatment of this type of cancer but the drugs used are still synthetic. This contains a wide range of adverse effects related to the chemical. In this research, natural extracts were used. by choosing to study extracts from Sang yod rice Affecting the development of MDA-MB 231 breast cancer cells followed by Wound healing assay, and showed that Sang yod rice extract As a result, the metastatic capacity of MDA-MB 231 breast cancer cells was significantly reduced. From the results of this study, it was found that Sang yod rice extract can inhibit the development of And control the progression of this type of breast cancer cells. which may be important for use in suppressor production or develop a drug to treat breast cancer type MDA-MB 231 in the future.

Keywords: Sang yod rice, Anthocyanin, Antioxidant, Breast cancer, MDA-MB 231

Species diversity of isopods in Amphawa Estuary, Samut Songkhram Province

Worradon Ngamboonkup*
Kasetsart University, Bangkok, Thailand worradon.n@ku.th

Koraon Wongkamhaeng Kasetsart University fscikaw@ku.ac.th

Isopods are invertebrates in Subphylum Crustacea. They are diverse in terms of species and habitats, occupying both terrestrial and aquatic habitats. However, in Thailand, the study of isopods is poorly known. This study aims to explore the species diversity of isopods in Amphawa Estuary, Samut Songkhram Province, during March – October 2023. The isopods were sampled by Ekman grab and seven artificial settlement pads, i.e., fine filter, coarse filter, flute board, coconut husk, dried oyster shell, doormat, and brush, submerged for 1 month. From that, a total of 4 species from 3 families were found. The dominant species was *Ischyromene* sp. The result revealed that Bangchang Creek contained the highest diversity, followed by Soi Mangkorn Tong, Ampawan Wittayalai School, and Darunanukrao School. Moreover, the coconut husk had the highest isopod diversity.

Keywords: Isopods, Amphawa Estuary, Species diversity, Samut Songkhram Province

Morphological variation of *Gehyra mutilata* in Thailand

Kritsada Rungrot*
Kasetsart University, Bangkok, Thailand kritsada.ru@live.ku.th

Anchalee Aowphol Kasetsart University fsciacl@ku.ac.th

Attapol Rujirawan Kasetsart University fsciapr@ku.ac.th

Common four-clawed gecko, *Gehyra mutilata* is widely distributed in Thailand and little is known for its biology. This study aimed to explore morphological variation of *G. mutilata* in Thailand based on 16 morphometric characters and 6 meristic characters of eighty-six adult specimens. The samples were divided into 10 population groups based on morphotype (*Gehyra* cf. *multilata*) and the mountain ranges. The differences in morphometric characters and meristic characters were analyzed using multivariate statistics. The principal component analysis (PCA) showed morphometric differences on a plot of the first two axes (PC I and PC II). These two axes accounted for 90.68% cumulative of the total variation. On the PC I axis, the factor loadings were most heavily loaded positively on body size representing 55.87 % of the variance. The PC II accounted for 34.82% of the total variance and loaded heavily and negatively on ventral scale row. Based on the PCI and PCII, the population (*Gehyra* cf. *multilata*) from Huai Yang, Prachuap Khiri Khan was distinctly separated from other population groups. However, the sample sizes in this study were insufficient for determining the morphological differences among populations, and additional specimens across geographical range in Thailand should be collected for further analysis.

Keywords: Taxonomy; Population; Mountain range; Morphometrics; Geographic distribution

Effect of ellagic acid on hippocampal neurons in mice with chronic cerebral

Muschima Yap*
Kasetsart University, Bangkok, Thailand Muschima.y@ku.th

Wachiryah Thong-asa Kasetsart University fsciwyth@ku.ac.th

Ellagic acid has antioxidative activity and acts as acetylcholinesterase inhibitor. It is very interesting using of ellagic acid against neurodegeneration according to chronic cerebral hypoperfusion. The objective of this study was to investigate the effect of ellagic acid on hippocampal neurons in mice with chronic cerebral hypoperfusion. Thirty male ICR mice were divided into 3 groups: Sham-veh, received surgery without right common carotid artery occlusion, Vo-veh, received surgery with right common carotid artery occlusion, and Ell100, received surgery with right common carotid artery occlusion and continuously oral administration of ellagic acid 100 mg/kg for 2 weeks. After that, brains were collected for evaluation of hippocampal histopathology in the areas of cornus ammonis (CA) 1, 3 and dentate gyrus (DG) using cresyl violet staining. The neurons were counted as viable and degenerating cells and represented as the percentage of neuronal degeneration. The results showed no significant difference of hippocampal CA, 3 and DG and therefore the effects of ellagic acid cannot be clearly elucidated.

Keywords: Ellagic acid, right common carotid artery occlusion, hippocampal, ICR mice, cerebral hypoperfusion.

Betanin's effect on blood glucose and pancreatic beta cells in mice with trimethyltin-induced toxicity

Yanisa Detpakdee*
Kasetsart University, Bangkok, Thailand yanisa.de@ku.th

Wachiryah Thong-asa Kasetsart University fsciwyth@ku.ac.th

Betanin is an amino acid with high antioxidant. It inhibits the growth of tumors and cancer and also has anti-diabetic activity. Nowadays, there are few studies of betanin's effects on glycemic control and pancreatic function enhancement. This research aimed to study the effects of betanin on blood glucose and pancreatic beta cells in trimethyltin-treated mice. Thirty male ICR mice were randomly divided into (1) Sham-veh, injection and oral administration with normal saline, (2) TMT-veh, injection with 1 mg/kg trimethyltin (TMT) and oral administration with normal saline, and (3) TMT-Bet100, injection with 1 mg/kg TMT and oral administration with betanin 100 mg/kg. One times TMT injection was followed by continuously oral administration for 3 weeks. Fasting blood glucose (FBG) was monitored once a week. Then, pancreas was collected and stained with H&E and anti-insulin Immunohistochemistry. The results showed that food intake and FBG not significant differences in all groups. TMT significantly induced beta cell number reduction while treatment with betanin help prevent the reduction of beta cell. Moreover, betanin significantly increased islet and beta cell numbers when compared to both Sham-veh and TMT-veh groups. We concluded that TMT reduced the number of beta cell but did not affect blood glucose levels and the number of Islet. In addition, betanin increased the number of Islet and beta cell without affecting blood glucose level.

Keywords: Betanin; Trimethyltin; Islet; Beta-cell; Blood glucose level

Analysis of composition of Thai gut microbiome with prebiotic supplementation using metagenome data

Preeyaporn Anujun*
Kasetsart University, Bangkok, Thailand preeyaporn.a@ku.th

Wanwipa Vongsangnak Kasetsart University, Bangkok, Thailand wanwipa.v@ku.ac.th

Gut microbiome plays an important role in human health. Currently, there is a great interest in utilizing diet to modulate microbial community compositions. Copra meal hydrolysate (CMH) is commonly used as a prebiotic to enhance health. However, the human gut microbiome analysis is poorly characterized at species level. In this study, we therefore aimed to analyze Thai gut microbial compositions after treatment with CMH. After analyzing whole-metagenome shotgun (WMGS) data underlying treatment with CMH, the predominant bacterial families e.g., *Ruminococcaceae*, *Coriobacteriaceae*, *Erysipelotrichaceae*, *Veillonellaceae* and *Acidaminococcaceae* were identified. Considering these families, two significant species i.e. *Agathobaculum butyricipoducens* and *Acidaminococcus intestini*, were involved in short-chain fatty acids (SCFAs) biosynthesis. This study suggests that CMH could be used as a potential prebiotic supplementation for the modulation and maintenance of gut microbiome.

Keywords: Copra meal hydrolysate (CMH); Human gut; Metagenomics; Microbiome; Prebiotic

The study of genetic relationship among Thai mulberry (*Morus spp.*) accessions based on nucleotide sequences of *trn*L-*trn*F Intergenic Spacer region.

Surapat Kanjanachumphon
Kasetsart University, Bangkok, Thailand surapat.ka@ku.th

Athipat Ngernmuen Kasetsart University athipat.ng@ku.th

Mulberry is one of the most important plants in Thailand due to its economic and medicinal. In Addition, various components of mulberry can be used for a variety of purposes. However, the genetic information of mulberry in Thailand is limited. Accordingly, the objective of this research is to study the genetic relationship of 30 Thai mulberries (*Mulberry* spp.) accessions based on nucleotide sequences of *trn*L-*trn*F Intergenic Spacer region. The DNA sample was extracted from their leaf samples and amplified by polymerase chain reaction with primers *trn*L-*trn*F-R and trnL-trnF-F and purified. Subsequently, the nucleotide sequences were analyzed with the nucleotide sequences of other eight species of *Morus* and 1 species of outgroup from NCBI database. We found that the length of amplified PCR product in *trn*L-*trn*F Intergenic Spacer region of Thai mulberries was approximately 460 bp. Construction of phylogenetic trees was investigated by MEGA11 by the Maximum likelihood method and was tested for confidence using Bootstrap values of 100 iterations. The results of phylogenetic tress showed that Thai mulberries were grouped in a single cluster and separated from outgroup. Moreover, All Thai mulberries were grouped together and separated from Asia *Morus* spp. which were clustered in another group that originated in China and Japan. Therefore, this study demonstrates *trn*L-*trn*F Intergenic Spacer region was not used effectively in the genetic discrimination among 30 Thai mulberry accessions. The other DNA markers need for effective identification of Thai mulberries, leading to efficient mulberry breeding to improve mulberry tolerance to unsuitable environments in the future.

Keywords: *trn*L-*trn*F intergenic spacer; Phylogenetic tree; Thai mulberry; Genetic relationship; Maximum likelihood

Effect of ellagic acid on cerebral cortex and striatal neurons in mice with chronic cerebral hypoperfusion

Chompoonut Makmee*
Kasetsart University, Bangkok, Thailand Chompoonut@ku.th

Wachiryha Tong-asa Kasetsart University fsciwyth@ku.ac.th

Cerebral hypoperfusion has important role in the pathogenesis of dementia. Due to blockage or narrowing of the vessels that deliver blood supply to the brain and resulting in vulnerable neuronal affected including dysfunction and death. This research investigated the effect of ellagic acid on cerebral cortex and striatal neurons mice with chronic cerebral hypoperfusion. Thirty male ICR mice were randomly divided into 3 groups: Sham group, underwent operation without right common carotid artery occlusion, UCO-veh group underwent right common carotid artery occlusion and UCO-100 group underwent right common carotid artery occlusion and received continuously oral administration with 100 mg/kg of ellagic acid for 2 weeks. Then brains were collected for neuronal pathological analysis and stained with cresly violet. Result showed that chronic cerebral hypoperfusion induced by permanent right common carotid artery occlusion cannot induce the significant cerebral cortex and striatal neuronal degeneration. Therefore, neuroprotective effect of ellagic acid cannot be clearly elucidated due to initial insignificant of neuronal degeneration.

Keywords: ellagic acid; cerebral hypoperfusion; mice; pathology; common carotid artery

Optimal conditions for laboratory culturing of *Cubaris murina*

Chakriya Rungrawi*
Kasetsart University, Bangkok, Thailand Chakriya.r@ku.th

Koraon Wongkamhaeng Kasetsart University koraon.w@ku.th

The isopods of the genus *Cubaris* are common circumtropical. Currently, the genus *Cubaris* is bred as a pet due to its variation of colour. This experiment examined the optimal conditions for rearing the *Cubaris murina*. The experiments included the survival rates of isopod rearing in 5 different bedding i.e., peat moss, facial tissues, sphagnum moss, sponge, and dry leaves; the optimum atmospheric humidity for survival by choosing 55%, 70%, and 90%; and the 4 different nutrients supplements suitable for growth i.e., instant food, spirulina, egg yolk, and yeast. The results revealed that the optimal bedding was the dry leaf. Moreover, the appropriate atmospheric humidity was 90%, while the spirulina provided the best survival. However, none of the bedding induced isopod reproduction.

Keywords: Isopod, Decomposer, Survival rate, Humidity, Nutrient

Effect of ellagic acid on anxiety in mice with chronic cerebral hypoperfusion

Chariya Siwilai*
Department of Zoology, Kasetsart University, Bangkok, Thailand
Chariya.si@live.ku.th

Wachiryah Thong-asa Kasetsart University fsciwyth@ku.ac.th

Anxiety disorder is associated with alteration of limbic brain area. Cerebral hypoperfusion is one of the causes of dementia and has been found to be associated with anxiety. This research investigated the effect of ellagic acid on anxiety-like behavior in mice with chronic cerebral hypoperfusion. Thirty male ICR mice were randomly divided into 3 groups: Sham-veh group, underwent operation without right common carotid artery occlusion, 1VO-veh group underwent right common carotid artery occlusion and the 1VO-Ell100 group underwent right common carotid artery occlusion with 100 mg/kg of ellagic oral administration. The results showed no significant difference of anxiety-like behavior in vessel occlusion group when compared to normal or those exposed to ellagic acid. The present study concluded that. Chronic cerebral hypoperfusion induced by permanent right common carotid artery during 4 weeks period is not enough to induce anxiety in mice. Therefore, treatment with ellagic acid unable to present the significant difference as well.

Keywords: Anxiety, chronic cerebral hypoperfusion, ellagic acid, male ICR mice, right common carotid

Morphological variation of *Dixonius siamensis* in Thailand

Purinut Numuan* Attapol Rujirawan Anchalee Aowphol
Kasetsart University, Bangkok, Thailand purinut.nu@ku.th

Anchalee Aowphol Kasetsart University fsciacl@ku.ac.th

Attapol Rujirawan Kasetsart University fsciapr@ku.ac.th

Siamese Leaf-toed gecko, *Dixonius siamensis* is widely distributed on mainland Southeast Asia. However, the research on taxonomy of *D. siamensis* have not been intensively conducted and morphological data are lacking. This study aimed to examine morphological variation of *D. siamensis* in Thailand based on morphometric and meristic data. The specimens were classified into 11 population groups based on mountain ranges. The principal component analysis showed morphometric differences on a plot of the first two axes (PC I and PC II). These two axes accounted for 72.30% cumulative of the total variation. On the PC I axis, the factor loadings were most heavily loaded positively on body size and paravertebral scale representing 44.43% % of the variance. The PC II accounted for 34.82% of the total variance and loaded heavily and positively on body size. In addition, populations from Phuket range and Nakhon Si Thammarat were distinctly separated from the populations from Dong Phayayen Range, Phetchbun Range, Thanon Thongchai Range and Luang Prabang Range on PCI axis. Therefore, the results from this study showed morphological differences among populations from mountain ranges in Thailand. However, the study on genetic relationship should be conducted for evaluating the taxonomic status of *D. siamensis*.

Keywords: Taxonomy; Population group; Mountain range; Morphometrics; Meristics

Effect of circHIPK3 on MDA MB231 breast cancer cell line development

Napatsawan Choopan*
Department of Zoology, Faculty of Science, Kasetsart University, Bangkok, Thailand
napatsawan.ch@ku.th

Mongkol Pongsuchart
Department of Zoology, Faculty of Science, Kasetsart University, Bangkok, Thailand
fscimkp@ku.ac.th

Circular RNA (circRNA) is a non-coding RNA that regulates the function of microRNAs, which are important biomarkers in the treatment of breast cancer. Therefore, circular RNA HIPK3 (circHIPK3) has a role in promoting or inhibiting the growth and proliferation of various cancer cells. In this study, the MDA MB231 breast cancer cell line, triple-negative breast cancer (TNBC), is the most highly aggressive form of breast cancer compared to other types. MDA MB231 breast cancer was selected from the Geo datasets by studying the effect of circ-SCMH1 has_circ_0011946. Influencing the proliferation of MDA MB231 breast cancer cells using the Wound healing assay to calculate the percent Wound Closures and T-Test: Paired Two-Sample for Means was found to affect the proliferation of MDA MB231 breast cancer cells. With decreased cell proliferation and from statistical calculations, it was found that there was a significant difference in proliferation. This results in better diagnosis and treatment of disease in the future.

Keywords: CircHIPK3; MDA MB231 breast cancer cell; Wound healing assay; Development

Identification of circHIPK3 target miRNA responsible for MCF7 breast cancer cell line development

Tachaporn Kanhachai*
Kasetsart University, Bangkok, Thailand tachaporn.k@ku.ac.th

Mongkol Pongsuchart Kasetsart University mongkol.pon@ku.th

Breast cancer is caused by abnormal cells within the duct breast or lobule of the breast and then cancer has spread to other organs. One of the causes of breast cancer is dysregulated Micro RNA (miRNAs). Their critical role involved cell proliferation, differentiation, and apoptosis. However, the same miRNAs can act as an oncogene or tumor suppressor depending on different cancer cells type. This study selected miR-654 as a target gene since circHIPK3 has been reported as a miR-654 regulator in many types of cancer. In this study, cell migration ability of the MCF-7 overexpressing miR654 cell was compared with MCF-7 transfected with empty plasmid using wound healing assay. The results have shown that overexpressing of miR-654 significant decreased migration ability of the MCF-7 cell at 36 and 48 hours (35.39% and 42.26% respectively) when compared with control (68.99% and 74.04% respectively) and MCF-7 with empty plasmid (70.50% and 75.89% respectively). In conclusion, miR-654 can inhibit MCF7 breast cancer cell migration. Thus miR-654 could be important for drug development, gene therapy, and target gene treatment in the future.

Keywords: Breast cancer; MCF7; miRNAs; miR-654; circHIPK3

Identification of circHIPK3 target miRNA responsible for MDA-MB-231 breast cancer cell line development

Chatsuda Surachaijarin*
Kasetsart University, Bangkok, Thailand chatsuda.sur@ku.th

Mongkol Pongsuchart Kasetsart University fscimkp@ku.ac.th

Breast cancer is a common disease and the leading cause of death among women. The breast cancer incidence continues to increase every year. New strategies for breast cancer treatment have been developed, but the mortality rate in patients with Triple-Negative Breast Cancer (TNBC) are unchanged. Recently, many reports described functions of miRNA on cancer progression. In this study, function of a miRNA (hsa_miR-136) in MDA-MB-231 breast cancer cells was selected because it has been reported for associated with cancer progression. The wound healing assays revealed that hsa_miR-136 influenced the development of breast cancer cells. It decreased the proliferation rate of MDA-MB-231 breast cancer cells. However, the effect was not significantly different. This may be due to factors from human error. The experimental results will be repeated in the future to confirm these results.

Keywords: Breast cancer; MDA-MB-231; miRNA; hsa_miR-136; wound healing assays

Gut contents of *Cerapus* sp. (Amphipoda: Senticaudata: Ischyroceridae) found at estuary in Amphawa District, Samut Songkhram Province, Thailand.

Nattavadee Tipsut*
Kasetsart University, Bangkok, Thailand nattavadee.ti@ku.th

Koraon Wongkamhaeng Kasetsart University koraon.w@ku.th

Amphipods in the genus *Cerapus* are tube-dwelling amphipods and found in coastal habitats. In the present study, a *Cerapus* sp. was found in the Mae Klong River mouth, Amphawa District, Samut Songkhram Province, Thailand. Herein, the gut contents of *Cerapus* sp. were investigated by thirty individuals (15 males and 15 females). Then count the number of items and calculate the composition of food in the gut. The major food items were fungus, algae, diatom, organic substance, and protozoa. There was no difference of food contents in both sexes. In summary, *Cerapus* sp. can be considered as a suspension feeder and detritus feeder.

Keywords: *genus Cerapus*, gut contents, feeding behavior.

Effect of Riceberry extract on MDA-MB-231 breast cancer cell line development

Sucharkree Hongkhamsrang
Kasetsart University, Bangkok, Thailand sucharkree.h@ku.th

Mongkol Pongsuchart Kasetsart University mongkol.pon@ku.th

In 2020, breast cancer is the cancer that is most frequently diagnosed worldwide as well as kill more women from cancer than any other type, according to statistics. Furthermore, surgery, radiation, and chemotherapy are some of the modern treatments used to treat breast cancer. The patient's body will be significantly impacted by the treatment. Currently, there are numerous studies on the benefits of Riceberry extract, which can inhibit the development and migration of cancer cells. Consequently, the researcher intended to investigate, using Riceberry rice extract, how Riceberry extract affected the development and migration of MDA-MB-231 breast cancer cells. The resultant extract was then adjusted to the concentration levels as follows 1, 10, 100 mg/mL. The researchers studied the effect of Riceberry extract at concentrations of 1, 10, 100 mg/ml, respectively, on the development and migration of MDA-MB-231 breast cancer cells by Wound healing assay. According to the study, when cancer cells were incubated with Riceberry extract at a concentration of 100 mg/mL for 48 hours as compared to the control group, their development and migration were significantly reduced. This study demonstrates that Riceberry extract can reduce the MDA-MB-231 breast cancer cells' capacity for migration. As a result, this research can be utilized to examine the specifics of Riceberry extract for potential medical advantages.

Keywords: Riceberry rice, MDA-MB-231 breast cancer, Wound healing assay, Cancer cell development, Cancer cell migration

Effect of Sang yod rice extract on MCF7 breast cancer cell line development

Oatchima Butlang
Kasetsart University, Bongkok, Thailand oatchima.b@ku.th

Mongkol Pongsuchart Kasetsart University mongkol.pon@ku.th

The breast cancer cell is the most in women in the world. Breast cancer is caused by abnormally dividing cells within the breast. Its effects on cancer metastasis to another of the body. Treatment options for Breast cancer in many ways. Including surgery, hormonal therapy, radiation therapy, biological therapy, and chemotherapy. But such treatment has quite a lot of side effects. The study aimed to determine the effects of Sang yod rice extract on MCF7 breast cancer cell line development because Sang yod rice is grown in Phatthalung province. Southern Thailand Contains antioxidants that help reduce the incidence of cancer. The breast cancer cell has utilized a model in this study. MCF7 breast cancer cells using cultured in 12 well plates. Sang yod rice was extracted using a boiling technique with a solvent (water). The extract was investigated for inhibiting the proliferation of cancer cells using the Wound healing assay. Measure the width and record the cell photographs at different intervals: 0, 12, 24, 36, and 48 hours. Our results Sang yod rice extract at a concentration of 1, 10, and 100 mg/ml inhibited the proliferation of MCF7 breast cancer cells in a significant difference ($p<0.05$). And at a concentration of 100 mg/ml for 48 hours. Cell migration (%) by Wound healing assay average was 10.82 percent the most inhibition and by comparison with the migration of control cells. This study has shown that Sang yod rice extract inhibits the proliferation of cancer cells in a dose dependent manner.

Keywords: MCF*7* breast cancer cell, Song yod rice extract, Wound healing assay, Migration, Concentration of rice extract

Study on serum protein expression in *Macaca arctoides* infected with Dengue virus

Chanikarn Hongwiangchan*
Kasetsart University, Bangkok, Thailand chanikran.h@live.ku.th

Wirasak Fungfuang Kasetsart University fsciwsf@ku.ac.th

Dengue fever (DENV1-4) is a worldwide pandemic that includes Thailand, and Aedes mosquitos are the disease's carriers. There isn't a particular medication available present and periodically still observe infections. The specific symptoms are circulatory failure and an activated immune system. According to reports, humans can transmit dengue disease by experimental transmission from animals. Therefore, testing the serum in nonhuman primates, which are the dengue virus's natural hosts. However, the protein's expression in the nonhuman primates' body after infection is unexplained. The aim of this research was to search into the protein expression in macaques (*Macaca arctoides*) with dengue virus antibodies. *M. arctoides* blood samples were collected at the Pala-U Waterfall in Kaeng Krachan National Park, Prachuap Khiri Khan Province, 33 samples. 90% plaque reduction neutralization (PRNT90) assays were used to identify DENV1-4 neutralizing antibodies. 16 out of 32 *M. arctoides* were discovered to be Dengue virus positive. Using tandem mass spectrometry and liquid chromatography, protein expression in a serum sample was evaluated. Major protein-protein interactions were evaluated using STITCH. The findings showed that 582 proteins were expressed, 9 of which were only existent ($\rho<0.05$) in *M. arctoides* with dengue virus antibodies. The protein interaction analysis revealed that nine proteins were involved in the inflammatory process, immune system, Blood coagulation and drugs used in the patient of dengue fever. The expression of this protein in *M. arctoides* with dengue virus antibodies suggests that, the virus affects the blood clotting process. Immune system causes inflammation and interacts with certain medications It is critical information for vaccine development or additional medication.

Keyword: Dengue virus; *Macaca arctoides*; Proteins; Immune system; Blood clotting system

Effects of ellagic acid on spatial learning, memory, and flexibility in mice with chronic cerebral hypoperfusion

Thitirat Srisuwan*
Kasetsart University, Bangkok, Thailand Thitirat.sri@ku.th

Wachiryah Thong-asa Kasetsart University fsciwyth@ku.ac.th

Chronic cerebral hypoperfusion, caused by ischemic stroke is considered one of the risk factors for dementia syndrome. Affect the deterioration of intelligence learning and remembering. This research investigated the effects of ellagic acid on spatial learning, memory, and flexibility in mice with chronic cerebral hypoperfusion. Thirty male ICR mice were randomly divided into 3 groups (1) Sham-veh were operation without permanent right common carotid artery occlusion, (2) Rco-veh and (3) Rco-Ell100 were operation with permanent right common carotid artery occlusion, and (3) receive 100 mg/kg of ellagic acid continuously for 1 week. To test spatial learning, memory, and flexibility with Morris water maze. The results showed that 5 weeks after operation did not significantly decrease spatial learning, memory, and flexibility. However, ellagic acid can significantly increase memory efficiency. Therefore, concluded that chronic cerebral hypoperfusion in mice by operation with permanent right common carotid artery occlusion in 5 weeks did not cause a statistically significant decrease in spatial learning, memory, and flexibility. And ellagic acid improve the efficiency of memory.

Keywords: Morris water maze; ellagic acid; spatial learning; spatial memory; learning flexibility

Serum protein expression of stump-tailed macaque (*Macaca arctoides*) infected with Zika virus

Walun Sinphuthorn*
Kasetsart University, Bangkok, Thailand walun.s@live.ku.th

Wirasak Fungfuang Kasetsart University fsciwsf@ku.ac.th

Zika virus is a virus that can be contacted by animals to mosquitoes. Zika fever affects severe nervous and brain disorders on human fetus. The objective of this study is to study the differences in the expression of the blood protein of the monkey that is infected with the Zika virus and in non -infected monkeys. By collecting 32 *Macaca arctoides* in the area of Pa La -U waterfall Kaeng Krachan National Park Prachuap Khiri Khan Province Detects Sika with Neutralizing Antibody. There are 5 infected, 27 non-infected monkeys and 1 antibodies. Analyze the expression of protein using LC-MS/MS. Using Stitch. The results showed that 9532 protein expressions found only 2 types of proteins expressed in infected monkey groups, namely Adamts-Like Protein 1 (Adamtsl1) and Cerebellar Degeneration-Related Protein 2-Like (CDR2L). ($p < 0.05$) with interaction with Serotonin, Tyrosine and MAPT, etc., which are proteins related to signal transmission within the cell. The result shows that the protein expressed in the blood of the monkeys infected with the Zika virus is a protein related to the transmission and the cell level. From the analysis of protein interaction, both types of proteins are associated with the inflammatory process, immunity response. The function of the nervous system and drug related to the treatment of Zika disease. It can be concluded that when *Macaca arctoides* infected with Zika, the virus will affect the expression of blood proteins related to signal transmission and cell levels, including the response to immunity, inflammatory processes and drugs.

Keywords: Zika virus; nervous system and brain; intracellular signaling; protein; proteomic

Effect of Ellagic Acid on Brain Oxidation in Mice with Chronic Cerebral Hypoperfusion

Wimonsiri Chanketkan*
Kasetsart University, Bangkok, Thailand Wimonsiri.cha@ku.th

Wachiryah Thong-asa Kasetsart University fsciwyth@ku.ac.th

Chronic cerebral hypoperfusion is one of major causes of dementia such as vascular dementia and Alzheimer's disease. The pathological mechanism of these diseases is associated with brain oxidative stress. This research investigated the effect of ellagic acid on brain oxidative status in mice with chronic cerebral hypoperfusion. Thirty male ICR mice were randomly divided into 3 groups: Sham-veh, received surgery without arterial occlusion, 1Vo-veh, received surgery with permanent right common carotid artery occlusion, and 1Vo-Ell100, received surgery with right common carotid artery occlusion and continuously oral administration of ellagic acid 100 mg/kg for 2 weeks. After that, brains were collected for evaluation of brain oxidative status using colorimetric method. The result of protein, lipid peroxidation and catalase activity showed no significant difference in all groups, but superoxide dismutase activity was significantly reduced. According to this result, we conclude that chronic cerebral hypoperfusion caused by permanent right common carotid artery occlusion for 5 weeks can reduce superoxide dismutase activity. In addition, treatment with ellagic acid cannot alleviate this enzyme activity.

Keyword: chronic cerebral hypoperfusion; oxidation; ellagic acid; Permanent tying of the right common carotid artery; enzyme

Effect of Riceberry extract on MCF7 breast cancer cell line development

Weerapong Numa*
Kasetsart University, Bangkok, Thailand weerapong.nu@ku.th

Mongkol Pongsuchart Kasetsart University fscimkp@ku.ac.th

Breast cancer, one of the most common diseases in women worldwide, is still reported with new cases and deaths in every year. Even though breast cancer treatment techniques have been developed and improved, side effects from drugs are still commonly found and cause complications for patients. Thus, natural extract is a promising way for cancer treatment when serious side effects are mild. Recently, riceberry, a Thai black rice that is originated from hybridization between black rice and Khao Dawk Mali 105, has been reported for high antioxidant properties and reduced the viability of many cancer cell types. However, the effect of riceberry extract on MCF7, a luminal A breast cancer that is commonly found in breast cancer patients, has not been reported. In this study, riceberry extract was used to treat MCF7 breast cancer cells by using a wound healing assay. Wound healing assay, a method to measure two-dimensional cell migration, has been performed by adding riceberry extract at concentrations of 1, 10 and 100 mg/ml into the MCF7 breast cancer cell and incubated for 12, 24, 36, 48 hr. The MCF7 treated by riceberry extract significantly decreased cell migration properties compared to the group that did not receive the riceberry extract. These results suggesting that riceberry extract had the ability to inhibit cell proliferation and migration of breast cancer cells, but in the human body there are many factors that can reduce the inhibitory properties of riceberry extract. Therefore, extensive mechanisms of riceberry extract on cancer development are needed for more potential and safety.

Keywords: Riceberry, MCF7 breast cancer cell, Cancer cell migration, Wound healing assay.

Plant Growth Promoting Activities and Antagonistic Activities of Endophytic Fungi Strain R3G3 Isolated from Organic Rice Roots against the Rice Blast Fungus, *Pyricularia oryzae*

Keerataya Thabchan *
Department of Bioscience and Technology, Kasetsart University, Bangkok, Thailand.
keerataya.t@live.ku.th

Piyangkun Lueangjaroenkit Kasetsart University piyangkun.lu@live.ku.th

Rice is a crucial crop for many people worldwide, especially in regions like Asia, Latin America, and parts of Africa. Thailand is one of the largest exporters of rice, exporting around 7 million tonnes per year. However, the prevalence of rice blast disease, caused by *Pyricularia oryzae*, has led to crop damage and a decline in rice exports in Thailand. Nowadays, farmers use chemicals to eliminate disease, which can have negative effects on humans and the environment. Therefore, this study aim to investigate plant promoting abilities and antifungal activity against rice blast fungi, *Pyricularia oryzae* of endophytic fungal strain R3G3 *in vitro* and under greenhouse conditions. The endophytic fungi strain R3G3 which isolated from organic rice root was identified as *Aspergillus cejpii* based on morphological characteristics and phylogenetic analysis. After 7 days, dual culture assay showed that strain R3G3 has an antagonistic effect on *Pyricularia oryzae* Guy11 and 40.3 with radial growth inhibited by 68.95% and 73.33%, respectively. The production of IAA in the PDB was detected using Salkowski's test. After 7 days of incubation, the results showed that the strain grown in PDB with tryptophan produced a higher concentration of IAA (25.45 µg/mL). But it not has the potential for phosphate solubilization. The inoculation of *A. cejpii* R3G3 promoted rice growth with the growth parameters of shoot height, root length, wet weight, and dry weight increasing and the chlorophyll content of the rice plants also increased by 13.64 mg/mL. In addition, strain R3G3 also helps the rice to produce grains faster by 15 days. The result obtained from this study concluded that *A. cejpii* strain R3G3 has the ability to promote plant growth by produced phytohormone and inhibit the growth of the rice blast fungus *Pyricularia oryzae in vitro* and under greenhouse conditions. Therefore, endophytic *A. cejpii* R3G3 has the potential to be a promising eco-friendly biocontrol agent and plant growth promoter for rice cultivation.

Keywords: Endophytic fungi, Rice blast, *Aspergillus Cejpii*, antagonistic, plant growth promoter

Development of Reverse Transcription PCR assay for Detection of Feline Coronavirus Infection

Chiraphat Kopduang*
Department of Bioscience and Technology, Kasetsart University, Bangkok, Thailand.
chiraphat.k@live.ku.th

Jatuporn Rattanasrisomporn Kasetsart University jatuporn.n@live.ku.th

Feline coronavirus (FCoV) is the causative agent of feline infectious peritonitis (FIP) that can be found worldwide. Methods of molecular detection that are simple and effective are required. A reverse transcriptase polymerase chain reaction (RT-PCR) for the detection of feline coronavirus (FCoV) was developed to detect the M gene of FCoV in cats with suspected FCoV infection using RT-PCR. Novel primers were specifically designed based on the gene of interest. The RT-PCR assay was highly specific and had no cross-reactivity with other related feline viruses. The sensitivity detection limit of our developed RT-PCR was folded. A total of 25 clinical samples. Were detected as 21 (84%) yielded positive results and 4 (16%) yielded negative results. Therefore, the use of RT-PCR in the diagnosis of FCoV infection might be quite useful. In the light of its performance specificity, sensitivity, and efficiency, this RT-PCR may be a valuable addition to the diagnostic for FIP and would be a fruitful alternative molecular diagnostic tool for veterinary detection of FCoV infection.

Keywords : feline coronavirus, FCoV, RT-PCR, M gene, FIP

screening cyclic peptide inhibits FIP main protease by molecular docking and enzymatic assay

Chalandhorn leangcharoenpong*
Department of Bioscience and Technology, Kasetsart University, Bangkok, Thailand.
chiraphat.k@live.ku.th

Kiattawee Choowongkomon Kasetsart University kiattawee.c@live.ku.th

Disease in cats carried by a Feline Coronavirus (FCoV). The FIPV Main Protease (M^{pro}) play a crucial role in therapeutic development since it plays an important function in the virus's reproduction. The aim of this study was to use a FRET approach to find peptides that might inhibit the enzymatic activity of FIPV M^{pro}. The optimal test conditions were employed for FRET experiments to enhance assay sensitivity and accuracy. we selected the five peptides with the highest binding affinities from a library of 16,000 peptide structures including (Cys-Arg-Arg-Arg-Cys, Arg-Arg-Arg, Arg-Glu-Arg, Arg-Arg-His, and Cys-Arg-Lys-Arg-Cys). The highest active pH for FIPV M^{pro} enzymatic activity was shown to be 7.5. The K_m value was discovered to be 2.98 μM, showing a strong substrate affinity for the FIPV M^{pro} enzyme. The enzyme can catalyze the reaction at a rather high rate, as indicated by the computed V_{max} value of 38.910 μM/sec. The HIV inhibitor lopinavir was used to compare the inhibitory activity of the discovered peptides. RRR, CRRRC, and lopinavir were shown to have IC50 values of 1.985 ± 3.731 μM, 21.29 ± 3.399 μM, and 123.7 ± 6.029 μM, respectively. These results indicate that the discovered peptides might be potential therapeutic substitutes for FIPV. Further investigation of the interaction between the identified peptides and FIPV M^{pro} revealed that the peptides formed hydrogen interactions with several residues involved in the catalytic activity of the enzyme, including Cys144 and His41. These interactions indicate that peptides are capable of forming specific interactions with enzymes. In summary, this study provides significant information on the possibility of peptides as FIPV therapeutic alternatives and emphasizes their ability to interact with enzymes, which may have effects on the development of drugs to treat various viral illnesses.

Keyword: Feline Coronavirus, FRET, peptide, IC_{50}, inhibition, main protease

Evaluation of the antioxidant activity of *Chlamydomonas reinhardtii* extract cultivated in a specific concentration of copper and zinc

Phak-di-phan Bawornchaikulpat*
Department of Bioscience and Technology, Kasetsart University, Bangkok, Thailand.
pongpak.t@live.ku.th

Chotika Yokthongwattana Kasetsart University chotika.s@live.ku.th

Due to its ability to combat free-radical damage caused by oxidative stress, the evaluation of antioxidant activity has gained significant attention. Prior research demonstrates that *Chlamydomonas reinhardtii*, a single-celled green micro-algae, exhibits considerable antioxidant properties. Nonetheless, the influence of distinct concentrations of heavy metals, particularly copper and zinc, on both its antioxidant activity and growth qualities have yet to be thoroughly examined. As a result, this investigation aimed to assess the antioxidant activity of *Chlamydomonas reinhardtii* extract cultivated within copper and zinc concentrations that were regulated. To accomplish this, *Chlamydomonas reinhardtii* was grown under controlled conditions with varying concentrations of copper and zinc. The antioxidant activity was then determined using established assays: the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay and the ferric reducing antioxidant power (FRAP) assay. These tests provide valuable insight regarding the extract's ability to neutralise free radicals and reduce ferric ions, respectively. Concurrently, the growth of *Chlamydomonas reinhardtii* was attentively monitored by measuring the optical density (OD) at 680 nm at the specific time points, 14 and 21 days. In addition, the cell count was measured with a hemocytometer, allowing for a direct evaluation of cell proliferation and biomass production. Highlighted by preliminary research, *Chlamydomonas reinhardtii* extract's antioxidant activity appears to be influenced by copper and zinc levels. This was demonstrated by increased DPPH scavenging activity and FRAP values, resulting from the presence of copper and zinc stimulating the synthesis of antioxidant bioactive compounds within the algae. Additionally, copper and zinc concentrations had an impact on *Chlamydomonas reinhardtii* growth characteristics, as evidenced by changes in OD measurements and cell count. This underscores the role of copper and zinc in driving algal proliferation. In conclusion, our research provides valuable insights into the antioxidant activity and development of *Chlamydomonas reinhardtii* when grown in particular copper and zinc concentrations. The results highlight the significance of the quantity of these trace elements in relation to the extract's antioxidant capacity. In addition, our analysis of growth characteristics illuminates how copper and zinc affect the proliferation of *Chlamydomonas reinhardtii* cells and the total production of biomass. These findings have practical implications for refining cultivation methods and maximising *Chlamydomonas reinhardtii* antioxidant-producing potential.

Keyword: *Chlamydomonas reinhardtii*, antioxidant activity, copper, zinc, heavy metal, oxidative stress, DPPH assay, FRAP assay, growth analysis, optical density measurement, bioactive compounds

Development of PCR for detection of Helicobacter pylori and Helicobacter felis

Ratchadaporn Pumpuang*
Department of Bioscience and Technology, Kasetsart University, Bangkok, Thailand.
ratchadaporn.pum@live.ku.th

Chantima Porksakorn Kasetsart University chantima.p@live.ku.th

Helicobacter pylori is a gram-negative bacterium that can colonize the stomach of humans and pet dogs and cause human gastrointestinal disease. The prevalence of gastric *Helicobacter pylori* in humans is high and the clinical symptoms can be vomiting and diarrhea, while its pathogenesis role in dogs is unknown. Since a gold standard of the culture-based method of *H. pylori* gives low sensitivity, an alternative detection method is needed. The aim of this study is to develop a PCR method to detect *H. pylori*. A pair of PCR primers were designed to be specific to the *ure*A gene of *H. pylori* with a 134-bp amplification product. The *ure*A gene of *H. pylori* can be accurately detected by PCR, while other urease-producing bacteria did not show a positive PCR result. In addition, the designed primers used in a real-time PCR have revealed their sensitivity of 10^1 copies. Therefore, the developed PCR will be useful for detecting *H. pylori* pathogens in a stomach sample, as an alternative way to diagnose *H. pylori*-caused gastrointestinal diseases in humans and dogs.

Expression levels of *Anopheles* target genes after dsRNA feeding

Vachiraporn Rattanachaichata*
Department of Bioscience and Technology, Kasetsart University, Bangkok, Thailand.
vachiraporn.r@live.ku.th

Anchanee Kubera Kasetsart University anchanee.s@live.ku.th

Malaria is one of the infectious diseases caused by *Plasmodium spp.* that affects deaths worldwide. The *Anopheles* mosquito is the primary vector of the disease. Our previous transcriptome analysis of *Anopheles dirus* after *P. vivax* infection revealed that the *cuticular protein RR-2 family (CPR129)* and *far upstream element-binding protein* were up-regulated after 18 hours post feeding, while *peptidase 212* and *kraken* were up-regulated at seven days post feeding. The purpose of the study was to reduce the expression of four genes, *cuticular protein RR-2 family (ADIR001095), far upstream element-binding protein (ADIR000228), kraken (ADIR000286),* and *peptidase 212 (ADIR001555),* using the double-strand RNA technique (dsRNA). The gene expression levels were measured by quantitative real-time polymerase chain reaction (qRT-PCR), results were using Excel LTSC 2021 and SPSS programs. The results showed that the expression of four genes was down-regulated on different days after dsRNA feeding. According to this study, the double-strand RNA technique (dsRNA) successfully decreased the mosquito gene expression. Therefore, further investigation on these four genes will be required to prevent the *plasmodium* transmission and reduce infection in *Anopheles dirus.*

Keywords: Gene expression, Malaria, *Anopheles*, dsRNA, qRT-PCR

Investigation of resveratrol biosynthesis in mulberry cell suspension culture

Supavit Pisansub*
Department of Bioscience and Technology, Kasetsart University, Bangkok, Thailand.
supavit.pa@live.ku.th

Wannarat Phonphoem Kasetsart University wannarat.p@ku.th

Mulberry (*Morus* spp.) is an economically important tree in Asia. Mulberry roots contain high levels of bioactive stilbenes, oxyresveratrol (OXY), and resveratrol (RES), which have significant impacts on the health product industry such as antioxidant, anti-cancer, anti-aging activities and promising anti-COVID-19 agents. However, the cultivation of mulberry trees requires a lengthy period before the large root can be collected, and the harvest season also affects the production level of secondary metabolites. Therefore, this research aims to investigate the effect of UV-C treatment on RES and OXY in mulberry cell suspension culture. The result showed that RES has an identical value under the UV-C stress treatment, yet partially OXY contents increased 2.3-fold compared to a normal growth situation. The results of this study indicated that UV-C treatment could induce OXY content in mulberry callus. This study could lead to the development of a more sustainable and efficient source of resveratrol and oxyresveratrol, which has an important health benefit for humans.

Keyword: Resveratrol; Oxyresveratrol; Callus; Mulberry