

I-KUSTARS 2015

May 28-29, 2015



*The International Kasetsart University
Science and Technology
Annual Research Symposium*

*Faculty of Science, Kasetsart University,
Bangkok Thailand*



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Research Symposium :I-KUSTARS 2015

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Preface



Dear Colleagues

On behalf of the organizing committee of the International Kasetsart University Science and Technology Annual Research Symposium 2015 (I-KUSTARS 2015), it is my great pleasure to extend a warm welcome to you to participate in this Symposium which is one of the significant occasions to celebrate 49th Anniversary of Faculty of Science and we commemorate the 72nd Anniversary of Kasetsart University for having been the Knowledge of the Land throughout these years.

I-KUSTARS 2015@Kasetsart is an exciting conference in science to provide opportunities for senior students, who are our future, to present their research work in a dedicated forum at the symposium. Leading by Plenary and invited speakers who pioneered their research field and made significant contributions in the area, this symposium is also a platform to strengthen current networks and to establish new collaborative links within Asian community and with the rest of the world. The scientific program comprises sessions that illustrate the relevance and value of modern science and technology.

We are looking forward to giving a warm welcome to you, and colleagues at I-KUSTARS 2015. We hope that you will find the Symposium both enjoyable and valuable. We thank you in advance for participating and contributing to the success of the event to mirror “*Knowledge of the Land*” for sustainable world.

With best wishes

Supa Hannongbua
Dean of Faculty of Science
Kasetsart University



Program Committee

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Wanna Malaphan	Department of Microbiology	



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09.00 A.M.-09.30 A.M.	Opening Ceremony
09.30 A.M.-10.15 A.M.	Plenary Session Better Life Through Organic Chemistry Research <i>By Prof.Boonsong Kongkathip</i>



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PLENARY SESSION



BIOGRAPHY



Professor Dr. Boonsong Kongkathip,

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Boonsong Kongkathip, b 1951. Organic chemist, graduated from the chemistry department, Mahidol University in 1972. M.Sc in organic chemistry from Mahidol University in 1974 and Ph.D. in organic Chemistry from Queen's University, Belfast, UK, in 1977. He joined the department of chemistry, Kasetsart University since 1978 as a lecturer, Assistant Professor (1981-1984), Associate Professor (1984-2013), Professor (2013-present). Osaka University (JSPS-NRCT research fellow, 1980), Australian National University (Visiting fellow, 1987), Tokyo University of Agriculture (JSPS-NRCT Visiting fellow, 1990), He received the outstanding researcher award from Kasetsart university in 1998. In 2008 he received the Asian Core Program Lectureship Award. Research interests: Synthesis of bioactive compounds, new synthetic methodology and natural products chemistry.



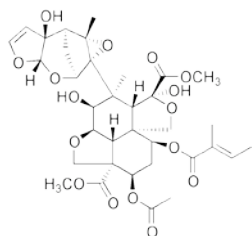
Better Life Through Organic Chemistry Research

Boonsong Kongkathip*, Ngampong Kongkathip

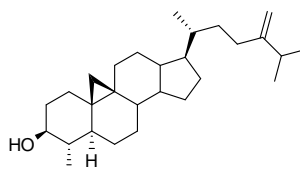
Natural Products and Organic Synthesis Research Unit (NPOS), Department of Chemistry and Center of Excellence for Innovation in Chemistry (PERCH-CIC), Faculty of Science, Kasetsart University, Chatuchak, Bangkok, 10900, Thailand.
fscibsk@ku.ac.th

Our future is dependent on the fruits of research in engineering and the physical sciences, such as chemistry, which play a critical role in developing economic growth and improving our quality of life. Many of the life-improving breakthroughs of the last century in areas such as health and medicine, food and agriculture, energy and the environment have been heavily dependent on advances in chemical knowledge. Organic chemistry research is one of the most important sciences for drugs development, green agriculture and industry. Department of Chemistry at Faculty of Science, Kasetsart University, Bangkok, Thailand offers a nice of cutting edge research. Ongoing research spans all the major areas of organic chemistry and encompasses a variety of the topics such as natural products, enzymatic processes, synthesis of important bioactive natural products, new asymmetric methods, and novel organometallic catalyst development.

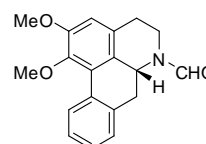
In this presentation, an overview of our research results in both natural products projects and new progresses on asymmetric synthesis of an anti-influenza drug (Tamiflu) will be given. We have been developing a new strategy to design and synthesize molecules with profound biological activities. I will also demonstrate how we can apply our discovery reactions to synthesize biologically active natural products.



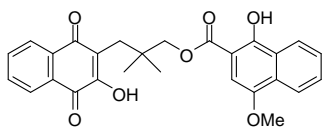
Azadirachtin



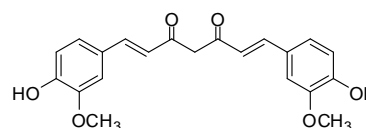
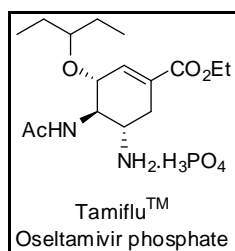
Cycloeucaenol



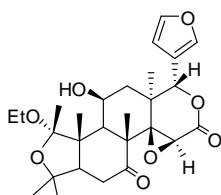
(-)-N-formylnornuciferine



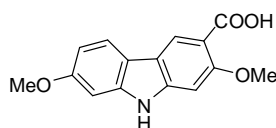
Rhinacanthin-N



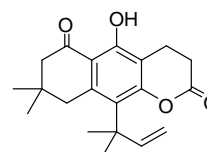
Curcumin



Clausenolide-1-ethyl ether



Clauszoline-J



Clausenidin



References:

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New Fermentation Technology with Thermotolerant Microbes

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Global temperature has been increasing due to the increase of carbon dioxide emission by utilization of fossil fuels including coal, petroleum and natural gas. Reduction of carbon dioxide emission has thus become an urgent issue, and biofuels derived from biomass have attracted attention as an alternative to fossil fuels. Since the worldwide demand for bioethanol has been increasing, the development of energy-saving, efficient ethanol production technology is required. Considering its advantages including reduction of cooling cost and saving water during the fermentation process, which consequently cut down the total running cost, high-temperature fermentation with thermotolerant microbes is expected to be one of new fermentation technologies. We have focused on the establishment of high-temperature fermentation technology for ethanol production, for which thermotolerant and stable microbes are essential, and advanced fermentation processes including a temperature-uncontrolled fermentation and a simultaneous fermentation and distillation under a low pressure have been investigated.

We showed the possibility that the thermotolerance of naturally isolated thermotolerant microbes can be further improved and the possibility of temperature-uncontrolled fermentation with *K. marxianus* DMKU3-1042. *Z. mobilis* is able to perform high-speed fermentation compared to yeast, and thus high-speed and high-temperature fermentation is expected with thermotolerant *Z. mobilis*. A thermo-adapted derivative from thermotolerant *Z. mobilis* TISTR548 showed significantly high levels of performance in growth and ethanol fermentation at a high temperature compared to those of the parent and also to *K. marxianus* DMKU3-1042 and *S. cerevisiae*. Furthermore, the thermotolerance of *K. marxianus* DMKU3-1042 and the thermo-adapted derivative of *Z. mobilis* TISTR548 were applied for a new technology of simultaneous fermentation and distillation under a low pressure at a high temperature. Both microbes were shown to be applicable to the new technology, but the *Z. mobilis* TISTR548 derivative exhibited much better performance than that of *K. marxianus* DMKU3-1042. Taken together, it is expected that high-temperature fermentation or simultaneous fermentation and distillation at high temperatures will become widely used in the fermentation industry in future, and thermotolerant microbes isolated from tropical countries or further thermo-adapted or stress-adapted mutants may be key factors for such application.

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Isolation, Characterization and Virulence Evaluation of *Corynespora Cassiicola* Isolates Causing Leaf Fall Disease on Rubber Tree in Vietnam

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The ascomycete fungus, *Corynesporacassiicola*, has been known as a widespread causal agent of *Corynespora* Leaf Fall (CLF) resulting serious damages in rubber trees around the world. *C. cassiicola* has many host plants and its pathogenicity has been caused by cassiicolin encoded by an important effector namely cassiicolin gene (*cas*) as previously demonstrated (Déonvàctv, 2012). Therefore, characterization of fungal pathogenicity is necessary for further experiments to understand their virulence and to find out effective methods in the prevention of CLF disease.

Three *C. cassiicola* strains (CoryLN01, CoryLN02, CoryLK23) were isolated in LocNing and Lai Khe provinces and described their cell growth, sporulation, infection structure formation and cytological analysis. The pathogenicity of *C. cassiicola* also was observed based on the drops of *C. cassiicola* conidia suspension applied on the surface of detached rubber tree leaves. In addition, the identification of *C. Corynespora* strains and the cassiicolin genes was also carried out using PCR methods.

The results indicated that there was nosignificant difference among three isolates in cell growth, sporulation, except for culturingin PSA medium. Their virulence was quite similar although the infection with CoryLK23 showed stronger than other two isolates (CoryLN02, CoryLN03). Furthermore, we also observed that clonal RRIV5 seem to be more susceptible to *C. cassiicola* than clonal RRIV124. The role of cassiicolin genes will be also discussed in this study.

Keywords: *Corynesporacassiicola*, *Corynespora* Leaf Fall (CLF), cassiicolin gene, rubber tree, the pathogenicity, virulence.





Analysis of DNA-binding domain and inducer-recognition domain of CbnR, a LysR-type transcriptional regulator from *Cupriavidus necator* NH9

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The LysR-type transcriptional regulator (LTTR) family is the largest regulator family in prokaryote and control sexpression of variety of genes, for example amino-acid biosynthesis, aromatic compound degradation, virulence and stress responses. The soil bacterium *Cupriavidus necator* NH9 has aLTTR, CbnR, which regulate sexpression of the *cbnABCD* gene cluster that is responsible for degradation of 3-chlorocatechol converted from 3-chlorobenzoate (3-CB). *cbnR* gene is located on upstream region of the *cbnABCD* genes divergently, and the activation of transcription is started when CbnR binds to the promoter DNA region and recognizes its effector, (chloro) muconate, intermediate from (chloro) catechol. CbnR has two domains, N-terminal DNA-binding domain (DBD, residues 1-58) and C-terminal inducer-recognition domain (IRD, residues 88-294). In this research 25 mutants of these domains were analyzed to reveal which amino acids were important for DNA binding and inducer recognition. CbnR mutants were constructed by site-directed mutagenesis and each amino acid was substituted for Alanine. Ability to activate transcription and DNA binding activity of these mutants were examined by β -galactosidase assay and electrophoretic mobility shift assay respectively.

From analysis of 17 DBD mutants, almost all mutant sexhibited decreased β -galactosidase activity or changed activity pattern, and lacked or raised DNA binding ability compared with wild-type CbnR. These results suggested that N-terminal region was involved in DNA binding strongly and especially Gln29 played a significant role for CbnR function. On the other hand, 6IRD mutants, F98A, T100A, K129A, R199A, F202A and V246A changed their response pattern to inducer relative to wild-type and their amino acids were located between RD-I and RD-II regions, expected to form an effector recognition site of CbnR. Two mutants, R199A and V246A, induced constitutive expression of *cbnA* promoter and these two amino acids were located on boundary phase of the dimer that make up the tetramer of CbnR, suggested that point mutation to these two amino acids changed the structure of CbnR tetramer. In short, it was suggested that C-terminal region of LTTRs was involved in inducer recognition and structural change directly.

Keywords: transcription, LysR-type transcriptional regulator, biodegradation





Biocontrol of tomato wilt disease by actinomycetes isolated from vegetables

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Tomato wilt disease caused by *Fusarium oxysporum* f. Sp. *Lycopersici* has a detrimental effect tomato production in Japan. Some actinomycetes are known to suppress the effects of phytopathogenic fungi. We have developed a functional compost, “ICHIGOICHIE”, that includes some actinomycetes, which is effective against strawberry anthracnose caused by *Glomerella cingulate*. The aim of this study was to obtain actinomycetes that suppress the activity of tomato wilt fungus in order to develop a new functional compost for biocontrol of tomato wilt disease.

We isolated 167 strains of actinomycetes after cultivation at 30 °C for 3 - 4 weeks on HV or diluted TSB agar plates from several kinds of vegetables and their rhizosphere soils. These strains were screened for their effectiveness in biocontrol of tomato wilt disease. Screening was carried out by growing tests in pots with soil containing a tomato wilt pathogen and actinomycetes. *Fusarium oxysporum* f. Sp. *Lycopersici* TR2-1 was used as a pathogen of tomato wilt disease. Tomato plants were cultivated for 4 – 6 weeks in an artificial climate chamber.

Fresh weights of tomato plants infected with the wilt pathogen were 60 -70% of these of healthy tomato plants. After the first screening, 4 groups (TG1, TG6, TG31, TG32) containing 15 strains were selected from 43 groups of isolated actinomycetes. In these tests, the fresh weights of tomato plants recovered to 80 - 85% of that of control plants. Strain KTS5 was selected from these groups after the second screening and showed the ability to restore the fresh weights of tomato plants to 85 - 90% of the control level. We are continuing to investigate the suppressive activity of strain KTS5 against *Fusarium oxysporum* on agar plates and the antifungal activity of the strain in a culture medium.

Keywords: biocontrol actinomycetes disease





Bioconversion of AOH by *Burkholderiacontaminans* CH-1

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A compound that stimulates the growth of bentgrass, 2-azahypoxanthine (AHX), was isolated from a mushroom, *Lepistasoldida*. AHX is metabolized to 2-oxohypoxanthine (AOH) in rice. Both compounds show plant growth-promoting activity and are present in rice at levels similar to those of plant hormones. AOH also imparts Arabidopsis with drought stress tolerance and cold stress tolerance. It is difficult to synthesize AOH by a chemical method, but AOH has been synthesized from AHX by xanthine oxidase. However, the concentration of AHX in the reaction mixture is very low (70 mg/L). To establish an effective method for the synthesis of AOH, we investigated the bioconversion of AOH by microorganisms.

AHX and AOH were analyzed by HPLC (Develosil C30-UG-5 column, 0.02% TFA, 30 °C, 254 nm). Strains of the genus *Burkholderia* and xanthine oxidase from butter milk were purchased from NBRC and ORIENTAL YEAST CO, LTD, respectively. The strains were cultured in TSB medium at 30 °C. The conversion of AOH was carried out in PBS (pH 7.4) at 30 °C or 40 °C in a test tube or flask.

Strain CH-1 was selected as a strain showing the highest AOH conversion activity in stock cultures of our laboratory. This strain was identified as *Burkholderiacontaminans* by performing molecular phylogenetic analysis of 16S rDNA. Strain CH-1 showed higher AOH conversion activity than those of type strains of the genus *Burkholderia*. Although xanthine oxidase could not convert 2 g/L of AHX to AOH at 30 °C by the product, strain CH-1 could convert 4 g/L of AHX to AOH at 40 °C. The cells in late logarithmic growth phase showed the highest activity among growth phases. In the experiments, 1.63 g of AOH was synthesized from 1.60 g of AHX in a resting cell reaction with strain CH-1. The reaction yield was 91.2%. The concentration of AHX in a resting cell reaction with strain CH-1 is about 60-times higher than that in the reaction of xanthine oxidase.

Keywords: AHX, AOH, Bioconversion





Prokaryotic Diversity in Alkane-oxidizing Methanogenic Community From Production Water of Oil and Gas Seep

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Methanogenic alkane degradation has been firstly reported in 1999 by Zengler et al. Since then, many reports have documented the structures of methanogenic communities degrading alkanes or crude oil. However, mechanism of the reaction still remains to be clarified. In particular, the initiator microbe(s) of alkane degradation is regarded as a key player of the reaction and seems to be phylogenetically diverse, hence their diversity and functions should be further studied. In this study, we constructed and analyzed alkane-oxidizing methanogenic community from a production water of an oil and gas seep in Japan.

Among examined alkanes (C_8 , C_{12} , and C_{16}), the community preferably degraded octane. About 85 % of electron from degraded octane was consumed for methanogenesis after 441 day of incubation at 30°C. Pyrosequencing analysis based on bacterial 16S rRNA gene showed that the most dominant taxa at the phylum level were changed from *Proteobacteria* in the production water into *Firmicutes* in the alkane-amended culture. At the family-level classification, uncultured *Peptococcaceae* was dominated and followed by uncultured *Syntrophaceae* in the culture. The function of the former was uncertain yet, but related sequences were also found in oil sands tailings and oil reservoirs. Catalyzed reporter deposition-FISH analysis on the subcultured alkane-amended culture revealed that the uncultured *Peptococcaceae* accounted for about 60% of total bacterial cells, suggesting that it may play an important role in the degradation of methanogenic alkane degradation. Closely related sequences to the uncultured *Syntrophaceae* were also detected from the first culture of methanogenic alkane degradation (Zengler et al., Nature, 1999) and similar environments but the uncultured *Syntrophaceae* still remain to be isolated and characterized. We subcultured the alkane-amended culture into media containing several fatty acids based on information of *Syntrophaceae* strains to isolate them. However, no bands affiliated to the *Syntrophaceae* were detected in DGGE gel, indicating that the *Syntrophaceae*-related microbes in our culture might not utilize fatty acids.

Keywords: microbial enhanced oil recovery, methanogen, uncultured prokaryotes





Compatibility Improvement in Wood Flour-PP/PE Composites

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Wood-plastic composites (WPCs) are materials made from wood flour, polymer, and additives. WPCs are stiff, durable, and have a texture similar to that of wood. It also incorporates biomass resources as a raw material and can be composed of recycled polymers. For that reason, WPCs have been experienced steady growth over the past years and attracted as an environmentally friendly material. In Japan, most of the polymers found in household waste are polypropylene (PP) and polyethylene (PE). These wastes are recycled into a PP/PE blend polymer because pure PP or PE is difficult to obtain. WPC, which is expected to expand to a mega market such as automobile parts, can suggest as valuable usage of PP/PE blend polymer.

The objective of this study is to improve the interfacial adhesion among wood flour, PP, and PE in order to allow the effective use of PP/PE blend polymer as a WPC matrix. Maleic anhydride-grafted PP (MaPP), maleic anhydride-grafted PE (MaPE), and an elastomer were used as compatibilizers. The effects of each compatibilizer were evaluated by determining the mechanical properties of WPCs made with commercial PP homopolymer and high-density PE. A polymer blend rich in PP (PP:PE=73:27) was used to increase stiffness. The proportion of wood flour was fixed at 25%, while the proportion of compatibilizer varied among the samples. Specimens for mechanical testing were prepared by injection molding. The results showed that WPCs containing MaPP had higher bending and impact strengths than those containing MaPE. Composites with both MaPP and MaPE did not show these enhancements. It appears that composites with MaPP had the properties similar to those of PP-based WPCs, while composites containing MaPE resembled to PE-based WPCs. The most desirable mechanical properties were observed in composites containing both MaPP and the elastomer. It is assumed that the elastomer improves the interfacial adhesion between PP and PE, while the MaPP improves the interfacial adhesion between PP and the wood flour. These results suggested that the improvement of interfacial adhesion was effective to enhance mechanical properties for a three-phase system composite mentioned in this study.





Effect of Density and Moisture Content on Temperature and Vapor Pressure Behavior During Hot Pressing

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In the particleboard production, hot pressing plays an important role in determining the overall performance of finished products. It provides interactive mechanism of heat and mass transfer, mat consolidation and adhesive setting. Determination of heat and mass transfer inside the mat is important to understand the interactive mechanism during hot pressing. The dominant factors for hot pressing process are temperature and vapor pressure. The aim of this study is to evaluate the effects of target density and mat moisture content (MC) on temperature and vapor pressure behaviors inside the mat during hot pressing. In this study, recycled wood particle obtained by knife-ring flaking process was used for laboratory-scale panel production. The target densities of board were 0.54, 0.61, 0.68, 0.75 and 0.82 g/cm³ with the board size of 340 × 320 × 10 mm and no resin was applied. The mats with MC of 5, 10, 15, 20 and 25 % were hot pressed at temperature of 180 °C with initial pressure of 3 MPa until the core reached the same temperature as the platen. A press monitoring system (Press MAN Lite, Alberta Research Council) was used to monitor the temperature and vapor pressure behavior inside the mat. The period of occurring constant temperature in the center of mat, called plateau time, and the constant temperature, named plateau temperature, were used as an indicator for determining temperature behavior inside the mat. The maximum vapor pressure and vapor pressure band (Vb), which is the duration where vapor pressure was higher than the half of maximum vapor pressure, were used for characterizing the vapor pressure behavior. This study found that both density and MC affected temperature and vapor pressure behavior inside the mat. The higher density resulted in longer plateau time, higher plateau temperature and higher vapor pressure. The higher MC resulted in longer plateau time, higher plateau temperature and higher vapor pressure. On the other hand, the Vb was not affected by MC. The Vb corresponded to the plateau time, especially in the case of panels with MC of 20 %. The maximum vapor pressure had strong relationship with plateau temperature. The higher maximum vapor pressure resulted in higher plateau temperature. The relationship between maximum vapor pressure and plateau temperature in this study corresponded to the theoretical relational expression based on Antoine equation.

Keywords: Wood-based panel, Hot pressing, Temperature behavior





Effect of Wet-Dry Cyclic Treatment on Dimensional Stability and Mechanical Properties of Wood-Based Panel

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Hygroscopic property is one of the important properties which influencing durability performance of the wood-based panel especially thickness swelling. The panel swell as a response of increasing moisture content and it has a deteriorating effect on other physical and mechanical properties of the panels. Some studies have been worked on laboratory accelerated aging tests to assess durability performance of the wood product but the results were reported too severe and focused on degradation only before and after aging treatment. The objective of this study was to investigate the effect of alternating wet and dry conditions on dimensional stability and particular strength properties during the treatment of a various commercial wood-based panels.

Four groups of panels, which are representative of commercial wood-based panels in Japan, plywood, oriented strand board (OSB), particleboard, and medium density fiberboard (MDF) were used. Each of group consisted of two types which different in adhesivetype, thickness or wood species. All panels were subjected to a wet-dry treatment for six cycles under laboratory-controlled conditions. Each cycle consisted of wet state in 40°C and 90% RH for 120 hours then followed by dry state in 40°C for 48 hours. At the end of each state of each cycle, weight changes (WC) and thickness swelling (TS) were measured and also elastic constant (Ed) and loss tangent were determined by non-destructive test. To clarify the aging intensity of wet-dry treatment in this study, ASTM 6 cycles are standardized method for laboratory aging test, were conducted as the comparing.

The results of this study showed that the changes of WC, which can indicate the mild intensity of the treatment, was fairly various among the panels. The change of WC of plywoods were higher than that of mat-formed panels which ranged 10 to 11 percent and 6 to 9 percent, respectively. The change of TS ranged from 2.5 to 6 percent and it has conversely pattern with change of WC for all panel. The TS increased with increasing number of cycle and OSB panels have the largest irrecoverable component among the others. The TS was considerably lower than TS in ASTM 6 cycles which reached about 26 percent. The Ed decreased by repeated cycling with the magnitude of Ed fluctuation during the treatment were different. The retention of Ed ranged from 80 to 100 percent depend on the panel type where plywood types have the largest values followed by MDF, OSB and particleboard. Loss tangent in elastic constant was about 0.010 to 0.019 in dry state, which particleboard showed larger values compared to rest of mat-formed panels. Loss tangents tend to increase with successive cycles. It was found that mechanical properties change caused by cyclic wet-dry treatment, even though the rate of more low that of ASTM 6 cycles.

Keywords: wood-based panel, accelerated aging test, non-destructive test





Physiological and Molecular Responses of Transgenic Tobacco Overexpressing Aluminum Tolerance Gene Candidate to Aluminum Stress

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Aluminum (Al) tolerance trait in rice is genetically controlled. One of the Al tolerance gene candidates is *B11* gene, which was isolated from Indonesian Al tolerant rice var. Hawara Bunar. The gene was introduced into tobacco to verify the role of the gene in Al tolerance mechanism. The objective of the research was to analyze physiological and molecular responses of transgenic tobacco overexpressing the *B11* gene to Al stress. The T3 generation of transgenic tobacco and its wild type were used in this experiment. The plants were grown in 1/6 strength MS agar media or in water nutrient culture media with 300 ppm of Al and pH 4.0. The plants were also grown on acid soil to observe the growth response to acid soil.

The root growth response was observed on the transgenic tobacco and its wild type after 5 weeks being stressed by 300 ppm Al. Citrate secretion, Al accumulation and lipid peroxidation in root tips were also observed in both Al and non Al stressed of transgenic and wild type tobacco. The expression of several responsive genes to Al stress, such as *STO1*, *MATE*, and *ALMT1* were analyzed using semi quantitative PCR technique.

The result showed that the transgenic tobacco growth better in Al stressed medium than that of the wild type as indicated by the root growth. Interestingly, transgenic tobacco produced more hair roots than its wild type. The transgenic tobacco also secreted more citrate, accumulated less Al and experienced less lipid peroxidation than those of the wild type when stressed with Al. When the transgenic tobacco grown on acid soil, it grew better than that of the wild type. Gene expression analyses revealed that *STO1*, *MATE*, and *ALMT1* expressed higher in transgenic tobacco than those in the wild type. As conclusion, the transgenic tobacco showed tolerance to Al stress suggesting that the *B11* gene has a role in Al tolerance mechanism in plant.

Keywords: acid soil, aluminum tolerance, rice





The Evaluation of Genetic Diversity of Kapulasan (*Nephelium ramboutan-ake* (Labill.) Leenh) in Java Island, Indonesia based on Microsatellite Markers

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Indonesia has huge diversity of fruit species, including kapulasan (*Nephelium ramboutan-ake* (Labill.) Leenh)). Kapulasan fruit is similar to rambutan rapih (*Nephelium lappaceum*) fruit with various taste, sour to sweet, but it has thick rind and no hair. Unfortunately, nowadays kapulasan population is getting rare. Information of genetic diversity is important for kapulasan improvement and conservation. The objective of this study was to analyze the genetic diversity of kapulasan in Java Island-Indonesia revealed by microsatellite markers.

The DNA of 63 individuals from 10 kapulasan populations was extracted using CTAB method, and amplified using two primer sets, LMLY6 (Forward-AAGGAATAAAGCTATCAATAA, Reverse-GATCTCTATCTCATCAAAC CT) dan LMLY12 (Forward-A GAAGCTGTCTTAACACTCCAC, Reverse-ACAAACCTAGA AACCAAAG). DNA amplification product was visualized and arranged in a matrix of binary data then analyzed using software *GenAlex*. A dendrogram was constructed based on Jaccard similarity Index and the *Unweighted Pair Group Method with Arithmetic Mean* (UPGMA).

The results of the genetic diversity analysis showed that the highest genetic diversity was found in North Bogor ($He=0.313$). The genetic diversity within population (61%) was higher than that among populations (39%). The similarity index ranged from 52 to 100% that means there are close relationships among individuals. Cluster analyses grouped some individuals originated from different locations in the same group. The levels of heterozygosity within a population was determined by the history of each individual in a population.

Keywords: Genetic diversity, *Nephelium ramboutan-ake* (Labill.) Leenh, Java island





A Tale of Two Hyper-diversities: Diversification dynamics of the two largest families of lichenized fungi

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Renewed interests in macroevolutionary dynamics have led to the proliferation of studies on diversification processes in large taxonomic groups, such as angiosperms, mammals, and birds. However, such a study has yet to be conducted in lichenized fungi – an extremely successful and diverse group of fungi. Analysing the most comprehensive time-calibrated phylogenies with a new analytical method, we illustrated drastically different diversification dynamics between two hyper-diverse families of lichenized fungi, Graphidaceae and Parmeliaceae, which represent more than a fourth of the total species diversity of lichenized fungi. Despite adopting a similar nutrition mode and having a similar number of species, Graphidaceae exhibited a lower speciation rate, while Parmeliaceae showed a sharp increase in speciation rate that corresponded with the aridification during the Oligocene-Miocene transition, suggesting their adaptive radiation into a novel arid habitat. Unlike, a few shifts in diversification rates in Graphidaceae appear to be associated more with the emergences and expansion of angiosperm-dominated forests – the main habitat and source for the substrate for lichens in Graphidaceae.





Comparative Study in Efficacy of Crude Extracts from Jackfruit Leaf, Sugarcane and Bitter Gourd to Inhibit the Growth of Cancer Cell

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Cancer is one of the leading causes of death in human, resulting in abnormal cell growth. The causes of this abnormality are both environmental and genetic. However, all causes of this irregular are affect to the abnormality genetic. And there are many causing side effect of chemotherapy drugs like hair loss, low blood cell count and mouth sores. The purpose of this comparative study in efficacy of crude extracts from jackfruit leaf (*Artocarpusheterophyllus* Lam.), sugarcane (*Saccharumofficinarum* Linn.) and bitter gourd (*Momordicacharantia* L.) to inhibit the growth of cancer cell is to make the database about the pharmacological of crude extracts from herb in Southeast Asia to inhibit the growth of cancer cell. For the future study to be one of alternative medicine to reduce not only the causing side effect of chemotherapy drugs but also the risk of cancer back after surgery. I study by incubate cancer cell by Dulbecco's Modified Eagle's Medium 50 μ L with each 100% v/v, 75% v/v and 50% v/v of each crude extracts from jackfruit leaf, bitter gourd and sugarcane, which are extract by Methyl alcohol, at 50 μ L for 0, 24, 72 and 120 hours. Next, measure the number of cell proliferation by MTT Reagent for assessing cell viability. NAD(P)H - dependent cellular oxidoreductase enzymes are capable of reducing the MTT Reagent to its insoluble formazan, which has a purple color, and record absorbance by microplate reader at 570 nm. The results showed that the solution of crude extract from jackfruit leaf at 75% v/v is the best to inhibit the growth of cancer cell. Furthermore, sugarcane may have the other compound of antioxidant to inhibit the growth of cancer cell.

Keywords: crude extract, jackfruit leaf, sugarcane, bitter gourd, inhibit the growth of cancer cell





Phenological Development of Roseleaf Raspberry (*Rubusrosifolius* Sm.) Under Medium and Low Elevation Conditions

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Roseleaf raspberry (*Rubusrosifolius* Sm.), a thorny weed in the highlands of Quezon province, Philippines, has been found to have market potential for fresh fruit, jam, juice, wine and tea. Analysis of its fruits' phytochemical contents also revealed promising medicinal properties. However, attempts to produce fruits at low elevation have failed while the specific influence of agrometeorological conditions in lower altitudes are yet to be studied. This study was conducted to provide preliminary data on the phenological characteristics of roseleaf raspberry plants at different elevations. The phenological behaviors of potted roseleaf raspberry plants were monitored in their native setting (774 masl) and at low (31 masl) elevation. An observed critical feature of individual roseleaf raspberry flowers regardless of elevation was the poor overlap of anther dehiscence and stigma receptivity. Failure to set fruit and the occurrence of flower abortion are abnormalities that were found to be the cause of the low fruit and flower production as well as poor fruit quality among plants at low elevation. Excessive heat accumulation in flowers and insufficient carbohydrate supply in the shoot apices are possible causes of the said abnormalities. Future studies aimed at enabling fruit production at low elevation may be focusing on the protection of flowers from heat stress and also on boosting the plants' carbohydrate resource at low elevation conditions.

Keywords: Roseleaf raspberry, Phenology, Fruit set





Bioactivity Screening of Selected Ethnomedicinal Plants of Balochistan, Pakistan

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Crude ethanolic extracts of *Acoruscalamus*, *Cichoriumintybus* and *Fumariaindica*, the ethnomedicinal plants of Balochistan (Pakistan), were selected to study for screening their antimicrobial activity against various ATCC strains of bacteria i.e. *Bacillus subtilis* (ATCC-6633), *E.coli* (ATCC-8739) and *Neisseria gonorrhoeae* (ATCC-31149), by Agar Well Diffusion Assay (Test concentrations: 10 μ l, 15 μ l, 20 μ l) and Disk Diffusion Assay (Test concentrations: 04 μ l, 06 μ l, 08 μ l) methods. Streptomycin was used as positive control against the bacterial strains and Dimethyl Sulphoxide (DMSO) was used as a negative control. Zones of Inhibition (ZOI), as the extent of antibiotic activity of herbs, were measured in millimeter (mm). The results revealed that *C.intybus* produced comparatively more effective results in Disk Diffusion method against *B.subtilis*(12 \pm 1, 15 \pm 1, 19.34 \pm 1.16, respectively) and *E.coli* (15.67 \pm 0.58, 17.34 \pm 0.58, 19 \pm 0, respectively) but *A.calamus* was found to be effective versus *N.gonorrhoeae* (12.4 \pm 0.6 and 13.4 \pm 0.6 at 10 μ l, 15 μ l, respectively). According to Agar Well Diffusion Assay, *A.calamus* expressed most antimicrobial activity against *Bacillus subtilis* (13.34 \pm 1.53, 18.34 \pm 1.53, 19.67 \pm 1.53, respectively) and *N.gonorrhoeae* (14 \pm 1, 16.67 \pm 0.58, 19.34 \pm 0.58, respectively) whereas, *C.intybus* was observed most toxic for *E.coli* (13.67 \pm 0.58, 15.34 \pm 0.58, 19 \pm 1, respectively). These results support the traditional medicinal usages of test ethnomedicinal plants against various disease and infections.

Keywords: ethnomedicinal plants, antimicrobial activity, Agar Well Diffusion Assay, Disk Diffusion Assay, zone of inhibition (ZOI)





Phytochemical Investigations of Some Medicinal Plants of Balochistan, Pakistan

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Medicinal plants are used by folks to treat the diseases since ages. The phytochemical constituents of plants play vital curative and therapeutic role against various diseases. These constituents are termed as primary metabolites (directly involved in growth and development) i.e. carbohydrates, lipids, proteins, and secondary metabolites (related with aesthetics and protection) i.e. alkaloids, flavonoids, fatty acids, etc. The current research was conducted for phytochemical screening of seven (07) ethnomedicinal plants of Balochistan that included *Acoruscalamus*, *Azadirachtaindica*, *Cichoriumintybus*, *Daturametel*, *Fumariaindica*, *Foeniculumvulgare*, and *Tecomellaundulata* for the availability of alkaloids, anthraquinones, carbohydrates, cardiacycosides, flavonoids, proteins, saponins, steroids, tannins and terpenoids. The results revealed that *A.calamus* and *D.metel* contained most of the tested primary and secondary metabolites whereas *F.indica* was found to be the most deficient at them. *F.indica* showed positive tests only for alkaloids, anthraquinones, flavonoids and tannins. These results confirm the medicinal activity of the tested ethnomedicinal plants.

Keywords: Ethnomedicinal plants, phytochemicals, alkaloids, flavonoids, tannins





Identification and Melanogenesis activity of polymethoxyflavones (PMFs) from *Kaempferiaparviflora* rhizome

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Kaempferiaparviflora is a Thai herb and the rhizome are rich with anthocyanin, polymethoxyflavone (PMF) and amino acid. PMFs including in rhizome are well known as good for slimming and anti-diabetes. We have recently investigated that synthesized PMFs from quercetin stimulated melanin biosynthesis in B16 melanoma cells ¹⁾. In this paper extraction, identification and melanogenesis activity of PMFs from the rhizome of *K.parviflora* were investigated.

Firstly, *K.parviflora* powder were extracted in methanol for 13 hrs. Investigating the components of methanol extracts of *K.parviflora* (KPM) using TLC, there are some spots with and without fluorescence under a UV light. A part of KPM were applied to silicagel open column chromatography to separate fluorescence fractions (Fr.1~Fr.4) and non fluorescence fraction (Fr.NF). As necessary, middle pressured LC and preparative HPLC were used to isolate Com.1~Com.6 from Fr.1~Fr.4 and Com. 7, 8, 10, 11 from Fr.NF. Results of structural analysis, Com.1~Com.6 had a basic structure as 5, 7-dimethoxyflavone and another 4 compounds as 5-hydroxy-7-methoxyflavone.

Secondly, B16 melanoma cells were treated with 10 PMFs for melanogenesis activity assay. Almost all compounds showed higher extracellular melanogenesis activity than that of theophylline as a positive control. However intracellular melanogenesis activity and cell viability had no changes. These results suggested that numbers and position of substituents are related to melanogenesis. Com.1 was used to evaluate expression of the tyrosinase which is the melanogenic enzyme by Western-blotting assay. Its expression of Com.1 were higher than that of blank. This means Com.1 promoted melanogenesis by increasing the amount of tyrosinase. The fluorescence compounds Com.1~Com.6 were used to evaluate cell shapes every 24 hrs (24, 48, 72 hrs) after treatment, as a result, they showed higher cell elongation than that of theophylline. This suggested that these compounds promoted some melanosome transportation. We concluded that PMF stimulated extracellular melanogenesis activity with melanosome transportation and cell elongation.

¹⁾Yamauchi et al., Bioorganic & Medicinal Chemistry, 2014, 22, 3331~3340.

Keywords: melanin, polymethoxyflavone, *Kaempferiaparviflora*





Screening Inhibitors Against Tyrosine Kinase

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Many human proteins are modified and precisely regulated by kinase activity. These kinases play critical roles in signal transduction that trigger biochemical chain of events inside the cell, creating many cell responses such as gene expression, immune response, cell differentiation, cell survival and cell apoptosis.

Misregulated kinase activity involve in uncontrolled cell proliferation that causes various types of cancers. From many studies, various small molecules are active against kinase activity which has been used as drugs for cancer treatment.

In this study, 1880 compounds derived from NCI database were virtually screened against the Extracellular signal-regulated kinase 2 (Erk2) and Janus kinase 3 (Jak3) by GOLD docking program. The patterns of protein-ligand interaction between the binding pocket residues of these proteins and the functional groups of these compounds were analysed with help of the SiMMap server.

Our *in silico* study revealed 20 potential compounds for Erk2 and 30 potential compounds for Jak3 against kinase activity. For compounds against Jak3, the Kinase-Gloassay were performed for testing the compounds *in vitro*. Our virtual screening method together with *in vitro* assay have a potential for identifying a new inhibitor for anti-cancer drug.





Utilization of Japanese Common Squid (*Todarodespacificus*) Liver for Fish Sauce Production

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Japanese common squid (*Todarodespacificus*) is the most popular shellfish in Japan, especially Hokkaido. Large amounts of squid processing wastes; viscera, ink, pen, blood and skin, etc., are generated each year causing environmental, health and economic problems. Squid liver is rich sources of enzyme such as metallo- proteases, cystine-proteases, serine-proteases and cathepsin D-like cystein-proteases. These enzymes have a potential to be used in food fermentation. Therefore, squid liver may have efficiency on fish sauce production by reducing fermentation time. The objective of this study was to determine enzyme properties from squid liver, effect of thermal myofibrils and apply this enzyme in fish sauce production.

The properties of enzyme from squid liver, optimal temperature and pH, stability of temperature and pH and tolerance of salt, were studied by using myofibrils of Pacific saury (*Cololabis saira*) as a model substrate. Enzyme activities were studied by monitoring the degradation profiles of myofibrillar proteins on SDS-PAGE. Enzyme from squid liver showed the highest activities at 55 °C and pH 9. The stability of enzymes were 15-55 °C and pH 6-10. These enzymes were tolerant at lower 20 % of salt content.

Effect of thermal myofibrils was studied by myofibrils were pre-heated at 55 °C for 30 min before fermentation with same enzymes at 35 °C for 60 min by estimation of enzyme activities on SDS-PAGE. Pre-heat of myofibrils was importance. It improves quality of protein degradation.

Fish sauce production, various amount of whole fish and fish meats (80, 79, 78, 75 and 70 g) were mixed with various amount of Japanese common squid liver (0, 1, 2, 5 and 10 g) and 20 % of salt. They were fermented at room temperature (25 °C) and refrigerator (4 °C) for 3 months. Appearances of fish sauces were determined with observation of color, texture, smell and flavor. Whole fish was a good material for fish sauce production. Squid liver improves fermentation of protein in fish muscle that reduced time of fish sauce production. Room temperature was more optimal for fish sauce production than refrigerator temperature. Whole fish with high squid liver and salt content at room temperature was optimal for fish sauce production. Color of pre-heat fish sauce was dark brown yellow color than un-heat fish sauce. Smell and flavor fish sauce were fishy and salty that looked similar to Thai fish sauce. Squid liver can applied for fish sauce production to reduce the fermentation time.

Keywords: Japanese common squid, liver, fish sauce





Cloning and Characterization of a *SAL1* Homologue from Thai Aromatic Rice KDML 105

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Climate and environment have significant impacts on plant growth and development. Unsuitable environment, either biotic or abiotic stress, can cause stress to the plants. *SAL1* is one of target genes involved in plant stress responses. Previous studies in *Arabidopsis thaliana* have shown that the mutated *SAL1* plants have ability to survive in drought environment and increased accumulation of 3'-phosphoadenosine 5'-phosphate (PAP) compared to wild-type plants. PAP is a substrate of 3', (2'), 5'-bisphosphate nucleotide phosphatase (*SAL1*), localized to the chloroplast. From NCBI database, there are two *SAL1* homologues, *Os12g0183200* and *Os12g0183300*. Our study focuses on *SAL1* gene in Indica rice, Khao Dawk Mali 105 (KDML 105). The purposes of this study are first, to identify the DNA sequence of *SAL1* in Thai rice by using *Os12g0183200* as a reference and second, to investigate a relationship between PAP accumulation and drought stress. DNA sequence analysis revealed that the *SAL1* homologue in KDML 105 rice consisted of 1,083-bp nucleotide sequence encoded 360 amino acid residues, with a calculated molecular mass and theoretical pI of 38 kDa and 5.29, respectively. The 3D structure prediction of this gene from amino acid sequences was performed by SWISS-MODEL and Swiss-PdbViewer program using HAL2 protein, an enzyme in hydrolase group from *Saccharomyces cerevisiae* as a template. The binding sites of *SAL1* homologue were analyzed via I-Mutant2.0 server and the result illustrated that *SAL1* homologue has lower binding efficiency towards PAP, compared with HAL2. For drought tolerance assessment, leaf relative water content (RWC) was measured. A decrease in RWC was observed during a period of drought. Moreover, PAP content was determined by High Performance Liquid Chromatography (HPLC) with fluorescence detector. Small quantity of PAP was detected in the plants after 10 days of drought. However, further investigation is required for PAP quantification in rice. Taken together, these results provide useful information, which could be applied for generation of drought tolerant rice in the future.





Expression and Characterization of *PmStylicin* from Black Tiger Shrimp, *Penaeusmonodon*

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Stylicin, an antimicrobial peptide family, was firstly reported in the Pacific blue shrimp (*Litopenaeusstylistis*). The stylicin homolog was identified in the black tiger shrimp, *Penaeusmonodon*. To elucidate the antimicrobial properties of *PmStylicin*, this study performed the expression of the recombinant thioredoxin-*PmStylicin* fusion protein (rTrx-*PmStylicin*) in *Escherichia coli* expression system. The thioredoxin tag was removed from rTrx-*PmStylicin* by enterokinase, and the r*PmStylicin* was subsequently recovered by nickel affinity chromatography. The purified protein was determined the antimicrobial activities against bacteria and fungi. The purified r*PmStylicin* protein at 64 μM exhibited about 40% growth inhibition of *Staphylococcus haemolyticus* but no growth inhibitory effect on *Bacillus megaterium*, *Staphylococcus aureus* and *E. coli*. Also r*PmStylicin* protein was tested for antibacterial activities against *Vibrio* species including *V. harveyi* and virulent *V. parahaemolyticus* (causing early mortality syndrome). The protein at 85 μM concentration exhibited no growth inhibitory effect on both *Vibrio* bacteria. Finally, the protein was tested for antifungal activity and showed slight inhibitory effect on the growth of *Fusarium oxysporum* at 143 μM . All above mean the Stylicin plays a key role associate with the immunity of shrimp.

Keywords: stylicin; antimicrobial peptide; black tiger shrimp; *Penaeusmonodon*





Analysis and Antioxidant Capacity of Anthocyanins From Mulberry

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Mulberry (*Morus*spp.) is considered as one of the economic crop plants in Northeast of Thailand. The mulberry fruit is a multiple fruit. It contains a high level of anthocyanins which can be used in several types of industries, such as food, beverages and cosmetics. Anthocyanins are responsible for attractive colors of fresh plant foods, fruits and vegetables, including orange, red, purple, blue and black colors. These compounds are water-soluble and easily extractable pigments, which belong to a class of molecules known as flavonoids synthesized via the phenylpropanoid pathway. Anthocyanins have been reported to exhibit a variety of biological activities, such as anti-inflammation, antimicrobial and antioxidant. Therefore, the objectives of this study are to analyze the anthocyanin content in mulberry fruits from different cultivars, study the effect of drought stress on anthocyanin accumulation in mulberry fruits and evaluate the antioxidant activity of anthocyanins. Quantification and qualification of anthocyanins in mulberry fruits under normal and drought conditions were performed using High Performance Liquid Chromatography (HPLC). Cyanidin-3-glucoside, a major anthocyanin found in plants, was used as a reference standard. The result indicated that under normal condition there was no significant difference in cyanidin-3-glucoside content in Kamphaengsaen (KS), Chiangmai (CM) and Buriram (BR) cultivars. Interestingly, drought stress markedly increased cyanidin-3-glucoside content in all 3 cultivars. Furthermore, the anthocyanin extracts were tested for antioxidant activity by using 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay. The results were calculated as the half maximal inhibitory concentration (IC_{50}) and Vitamin C (L-ascorbic acid) was used as a positive control. It was found that the IC_{50} value of anthocyanins was 450 $\mu\text{g/mL}$, whereas the IC_{50} of Vitamin C was 6.34 $\mu\text{g/mL}$. Taken together, the results obtained from this study will provide a basis for developing anthocyanin-rich mulberries as functional foods, medicines and cosmetics.





Comparison antioxidant activity between collagen hydrolysate from white jellyfish (*Lobonemasmithii*) and bester sturgeon (*Husohuso x Acipenserruthenus*)

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Many human diseases are known to be caused by free radicals and the natural antioxidants that can act as free radical scavengers. Protein hydrolysates or peptide from fish, jellyfish and shellfish, as well as their by-products have been shown to exhibit antioxidant activity. The purpose of this study was to compare antioxidant activity between collagen hydrolysate from white jellyfish (*Lobonemasmithii*) and bester sturgeon (*Husohuso x Acipenserruthenus*). Collagen from white jellyfish and collagen from bester were extracted by acid-solubilized collagen (ASC) and Pepsin-solubilized collagen (PSC). Acid-solubilized collagen (ASC) were extracted by cleaned white jellyfish and swim bladder of sturgeon were extracted with 1.0 M acetic acid in a ratio of 1:10 (w/v) for 24 h and pepsin-solubilized collagen (PSC) was extracted same as ASC and add 4% pepsin (w/v). The acid-solubilized jellyfish collagen hydrolysate (AJH), pepsin-solubilized jellyfish collagen hydrolysate (PJH), acid-solubilized sturgeon collagen hydrolysate (ASH) and pepsin-solubilized sturgeon collagen hydrolysate (PSH) were hydrolyzed collagen with buffer pH 7 in autoclave 121°C at 1.5 Pa for 180 min. The yield of all collagen hydrolysate (AJH, PJH, ASH and PSH) were 1, 10, 46 and 13% (based on the wet weight of sample), respectively.

Four hydrolyses were shown to affect the antioxidative activity and properties of resulting extracts from all collagen hydrolysate. Extracting the antioxidants from pepsin-solubilized jellyfish collagen hydrolysate (PJH) as evidenced by the highest DPPH (2,2-diphenyl-1-picryl hydrazyl) radical scavenging activity (EC₅₀, 15 mg/ml) while that jellyfish collagen hydrolysate (AJH) had radical scavenging activity 42%, pepsin-solubilized sturgeon collagen hydrolysate (PSH) and acid-solubilized sturgeon collagen hydrolysate (ASH) showed small DPPH radical scavenging activity. All collagen hydrolysate have highest ABTS (2,2-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)) (IC₅₀, 2 mg/ml) and chelation of metal ion (IC₅₀, 0.2 mg/ml) higher than vitamin C (IC₅₀, 10.5 mg/ml). Therefore, four collagen hydrolyses were used as important active components because of their excellent bioactivity, good biocompatibility, good penetrability and non-irritation of the body that can apply in functional food, beverages and dietary supplements.





Model Pretreatment Design for Efficient Ethanol Yield and Zero Waste Biorefinery: A Review

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Overcoming the recalcitrance of lignocellulosic biomass is a key step in the production of fuels and chemicals. The recalcitrance is due to the highly crystalline structure of cellulose which is embedded in a matrix of polymers-lignin and hemicellulose. Many physicochemical structural and compositional factors hinder the hydrolysis of cellulose present in biomass to sugars and other organic compounds that can later be converted to fuels. Biorefinery is a facility for the production of fuels, chemicals and value added products from biomass with highest economic potential to tackle the increasing emission of carbon dioxide. The pretreatment, being the basic step of biorefinery, plays a vital role in making the cellulose accessible for hydrolysis to attain the zero percent waste goal of biorefinery. Various pretreatment techniques change the physical and chemical structure of the lignocellulosic biomass and improve hydrolysis rates. During the past few years a large number of pretreatment methods have been developed, including alkali treatment, ammonia explosion, and others. Many methods have been shown to result in high sugar yields, above 90% of the theoretical yield for lignocellulosic biomasses such as Soft wood, hard wood, grasses, corn. The current review paper consists of various pretreatment methods and the recent literature that has reported on the use of these technologies for pretreatment of various lignocellulosic biomasses.

Keywords: pretreatment, biorefinery, ammonia explosion, lignocellulosic biomass, recalcitrance





Antennal Sensilla Distribution of Different Castes of Honey Bee *Apis andreniformis* and *Apis cerana* (Hymenoptera: Apidae)

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Honey bee consist of three castes are queen, drone and worker. Those castes show different behavior in the colony; the queen has the role in producing eggs and controlling pheromone, while drones mate the queen. The workers have the role in cleaning the nest, brood and queen tending, comb building, food handling, ventilation, guard duty, orientation flights, and foraging. Their activities need a complex communication, mediating by antennal sensilla. However, lack of information for the density and distributions on anterior and posterior side of antenna in three castes, in particularly queen and drone of *A. andreniformis* and *A. cerana*. Therefore, the objectives of this research were to analyse type, density, and distributions the antennal sensilla on anterior and posterior sides of queen, drone, and worker castes of *A. andreniformis* and *A. cerana*. Sample of *A. andreniformis* was collected in West Sumatra and *A. cerana* was collected in West Java. Antennal sensilla was analysed by using Scanning Electron Microscope. The result show that flagellar were found six types of sensilla in *A. andreniformis* and *A. cerana*: trichodea, bassiconica, placodea, campaniform, ampulacea, and coeloconica. Sensilla trichodea consist of four variants those are trichodea A, B, C, and D. Density of sensilla of workers are the highest among other castes, suggest that workers use olfactory sensilla to more variation activities in inside and outside of colony. Density total of sensilla *A. cerana* are higher than *A. andreniformis*. However, the distribution of sensilla bassiconica, campaniform and coeloconica were found more in open nesting *A. andreniformis* more than cavity nesting *A. cerana*. Thus, open air nesting *A. andreniformis* which are the comb of cell are exposed (Winston 1991), might be need more sensilla as hygro- and thermoreceptor to detected the temperature and humidity are fluctuation than cavity nesting *A. cerana*. Sensilla types are unequally distribute between castes in *A. cerana* and between flagellar side in *A. andreniformis*. Those suggest *A. andreniformis* are open nest might be need more sensilla to detected temperature and humidity, opposite the *A. cerana* are cavity-nesting might be easier to detected it. Density of sensilla on anterior are the higher posterior side. All types of sensilla are prominent on the upper end flagella, except trichodea A. Those suggest to efficient reception the odor or other stimulant from the front and upper end of flagellar.

Keywords: *A. andreniformis*, *A. cerana*, antennal sensilla





Diversity and Foraging Behavior of Stingless Bee *Trigona* IN Two Types of Land Use

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The objective of this research is to study the diversity and foraging behaviour of stingless bee in the oil palm and rubber plantation and to study the correlation between foraging behaviour and environmental factors. Three colonies of stingless bee were explored from secondary forest and one colony from the local people in the village around Harapan forest (Jambi). The nest and each colony inserted to an experimental box. Two colonies placed in oil palm plantation and two colonies in rubber plantation. The foraging behaviour was observed from 6 am – 6 pm within ten days for each habitat (except between 12 am-2 pm). Number of foraging bees that back to the nest with- and without pollen and resin was counted for 10 minutes with 10 minutes interval using counter. Environmental factors (temperature, humidity and light intensity) were recorded every hour. Stingless bee that was found is two colony of *Trigona terminata*, one colony of *T. moorei* and one colony of *T. drescheri*. *Trigona terminata* is characterized with mesoscutum peripherally covered with scale-like tomentum that colored bright yellow brown. *Trigona moorei* has black bristles clypeus. *Trigona drescheri* has blackish head except clypeus. All of colony *Trigona* back to the nest start from morning until afternoon. *Trigona terminata* and *T. moorei* that was observed in oil palm plantation showed similar foraging behaviour. *Trigona* that back bring pollen and resin increased from morning until noon (7 am until 12 am) and the decreased in the afternoon. *T. terminata* that observed in rubber plantation back bring pollen and resin start from morning (9 am), showing a peak in the afternoon (2 pm until 3 pm) and then decreased. *T. drescheri* was also observed in rubber plantation, only a little number of bee's that back brought pollen and resin. Foraging behaviour showed positive correlation with temperature and the light intensity, and negative correlation with the humidity. This study implied that *Trigona* can adapt their foraging behaviour in oil palm and rubber plantation and foraging behaviour within the course of research.

Keywords: Apidae, *Trigonaterminata*, transformation habitat, foraging behaviour, pollen, resin





Antioxidant effects of *Tiliacora triandra* leaves extract in brain tissue of ischemic reperfusion mice

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Transient cerebral ischemia is one of the major causes of neurological disorder which was found in dementia. It associates with the increase of oxidative stress and lead to neuronal damage. The present study aimed to investigate the effect of *Tiliacora triandra* leaves extract on the brain oxidative stress in transient cerebral ischemic mice. Thirty male ICR mice were randomly divided into 5 groups of SHAM + 10% tween 80, t2VO + 10% tween 80, t2VO + 300, t2VO + 600, t2VO + Quercetin, mice were orally administered with vehicle (10% Tween 80) and/or *T. triandra* extract (300 and 600 mg/kg), Quercetin (10 mg/kg) for 15 days before surgery. Transient cerebral ischemia (t2VO) was induced by 30 minutes bilateral common carotid artery occlusion followed by 45 minutes of reperfusion. Oxidative stress evaluation were total protein level, catalase (CAT), reduced glutathione (GSH), superoxide dismutase (SOD), lipid peroxidation (malondialdehyde; MDA) and calcium level. The result showed that the GSH, CAT and SOD were significantly increased in t2VO + 300, t2VO + 600 and t2VO + Quercetin in contrary with MDA and calcium level that were significantly decreased. The present study concluded that *T. triandra* leaves extract had neuroprotective effect against ischemic reperfusion injury via the prevention of oxidative stress.





Acute Toxicity of Insecticide Malathion to Glochidia Freshwater Pearl Mussel, *Hyriopsisbialata* Simpson, 1900

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Malathion is one of the most used in agriculture for insecticides which finally discharged to aquatic environment. The acute toxicity of a commercial malathion formulation (36.9% w/v active ingredient) to glochidia freshwater mussel (*Hyriopsisbialata* Simpson, 1900) was determined by static bioassay method at the water temperature of 27 °C. The experiment was carried out during December 2014 to February 2015 at Department of Zoology, Faculty of Science, Kasetsart University. Glochidia were exposed to malathion at concentrations of 0, 10, 20, 30 and 40 mg/L for 24 and 48 h. Each concentration had 3 replications. Percentage of survival was observed under light microscope. The results showed that median effective concentrations (EC₅₀) with 95% confidential level of malathion at 24 and 48 h were 22.39 (19.38-25.73) and 17.50 (13.53-27.33) mg/L, respectively. The results indicated that the malathion residual concentrations in the aquatic environment that have been reported (0.001-0.06 mg/L) are lower than the malathion EC₅₀ values in this study, thus, under those use regimes it may not cause acute toxicity to glochidia.





Feeding ecology of sympatric skinks in the Sakaerat Environmental Research Station, Nakhon Ratchasima Province

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Food partitioning among four species of sympatric skinks i.e., *Lygosoma bowringii*, *Eutropis macularia*, *Sphenomorphus maculatus* and *Lipinia vittigera* were investigated at Sakaerat Environmental Research Station, Nakhon Ratchasima Province between July and August, 2015. The objective is to determine diet composition and role of diet in skinks that coexist in the study site. Six study sites in the dry dipterocarp forest were surveyed using drift fences and pit fall traps. Each site was surveyed at 0800, 1000 and 1300 hrs. Four skink genera and 22 individuals were captured, consisting of 11 *L. bowringii* (SVL = 41.06 ± 8.103), eight *E. macularia* (SVL = 50.03 ± 13.42), two *S. maculatus* (SVL = 64.92) and one *L. vittigera* (SVL = 38.7). Stomachs were removed and preserved in 10% formalin and later transferred to 70% ethyl alcohol for further analysis. The diet composition was identified to taxonomic categories under stereomicroscope.

Results showed that nine food items were found in the diet of four skink species which were Isoptera (51.14%), Araneae (16.33%), Hymenoptera (8.14%), Orthoptera (4.081%), Blattaria (4.081%), Nematod (4.081%), Mantodea (2.04%), Centipede (2.041%) and Pseudoscorpion (2.041%). The major food items of *L. bowringii*, *E. macularia*, and *S. maculatus* were similar which were Isoptera, Hymenoptera and Araneae. Comparing the niche breadth among species, it was found that *L. bowringii* had highest niche breadth ($B = 4.4$), followed by *S. maculatus* ($B = 4.0$), *L. vittigera* ($B = 2.7$) and *E. macularia* ($B = 1.4$). Niche overlap was high in three species pairs which were *E. macularia* and *L. bowringii* ($O_{ij} = 0.75$), followed by *S. maculatus* and *E. macularia* ($O_{ij} = 0.52$), and *L. bowringii* and *L. vittigera* ($O_{ij} = 0.51$).

In conclusion, the information on diet analysis of four sympatric skink species indicated the ecological requirement of each species in their habitat. Moreover, this study provided the basic knowledge on ecology of skinks in Thailand and could be used for conservation implication in the future.





The *in vivo* effect of *Aegle marmelos* bark extract on regeneration of planarian

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In this study, the toxicity of *A. marmelos* extract on the regeneration of planarians was tested by using the morphology and proliferation of neoblast. *A. marmelos* extract is the one of the most plant extract that toxic on some invertebrates and is able to inhibit cell growth and cell proliferation *in vitro* human cell lines including *in vivo* sea urchin embryo. The results showed that 1, 3 and 5 % crude extract of *A. marmelos* in 0.1 % dimethylsulfoxide (DMSO) did not affect on planarians because the fragments of planarians treated with their treatments could be complete regenerate as a control and the number of neoblast were not significantly differ from the control. In the other hand, 7 % of *A. marmelos* was caused on the mortality of planarians within 24 hrs after amputation. In conclusion, the low concentration of *A. marmelos* extract (1 – 5 %) could not be toxic on planarians, while the higher concentrates are necessary to evaluate in further studies.





Protein Pattern Analysis in Gummy Jelly Contained Freeze-dried Crocodile Blood Product

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Freeze-dried crocodile blood capsule product is the first crocodile blood dietary supplement of the world. It developed under Thai petty patent No. 5074 of Crocodile Research Unit, Department of Zoology, Faculty of Science, Kasetsart University, Bangkok, Thailand since the year 2006. It has been used for promoting health in the people who suffer from anemia and allergies. For children, they could not swallow a capsule or anything until it has been completely chewed. Gummy jelly is alternative choice for children who are unable to swallow them whole. Then, gummy jelly contained freeze-dried crocodile blood (GJ-CB) product was developed under Thai Petty Patent No.9089, Kasetsart University, 2014 for promoting health.

GJ-CB products were added with crocodile blood powder in various temperatures (50°C, 70°C and 90°C) in the last step of production. The experiments were performed to observe the effects of temperature on total protein in GJ-CB products. Gelatin protein in the products was eliminated by its melting physical property. Then, the crocodile blood fraction was analyzed for total protein concentration by the Bradford protein assay and determined its protein pattern using 12.5% sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) in a reducing condition.

The results showed that protein patterns are present only in GJ-CB product at 50°C. There were 6 dominant protein bands (13.2, 25.1, 27, 57.5, 80.4 and 175.8 kDa) that correlated with protein pattern of freeze-dried crocodile blood capsules. These results reveal that GJ-CB products still contain protein or amino acid which is very useful for promoting health and suitable to use as dietary supplement for people who suffer from anemia and allergies.





Isolation and Identification of Endophytic Actinomycetes from *Acacia mangium* Willd. Using 16S rRNA Sequences

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Twenty-three strains of endophytic actinomycetes were isolated from roots of brown salwood (*Acacia mangium* Willd.) collected from Kasetsart University. Analysis of morphological characteristics and 16S rRNA gene sequences of those strains revealed that they belong to member of general *Streptomyces* and *Amycolatopsis*. Fifteen strains of endophytic actinomycetes showed antimicrobial activities against *Bacillus cereus*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Escherichia coli*. Strain GKU 8111 exhibited the best activity against Gram-positive bacteria. Twenty-two strains were active against *Aspergillus niger* as well as plant pathogenic fungi, *Fusarium moniliforme* and *Collectotrichum falcatum*. Strain GKU 8133 strongly inhibited the growth of all fungus.





Correlation study between oviposition time and offspring of the gregarious parasitoid, *Cotesia kariyai* (Hymenoptera: Braconidae)

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The gregarious parasitoid, *Cotesia kariyai* Watanabe (Hymenoptera: Braconidae), a parasitoid of the polyphagous herbivore, *Mythimna separata* Walker (Lepidoptera: Noctuidae) was examined of its correlation between the number of parasitoid emergence and oviposition time. Fourth or fifth instar host larvae were parasitized by 3-day-old wasps and oviposition time were recorded under laboratory conditions (16L: 8D, $25 \pm 1^\circ\text{C}$). Host larvae were kept in a laboratory room condition to records offspring emergence. Our results showed that the oviposition time and the F1 parasitoids clutch size had no significant correlation. Therefore, oviposition time could not be used as an index of the offspring clutch size in this parasitoid.





Direct Synthesis of Dimethyl Ether from Carbon Dioxide Over Copper Alumina Catalyst Prepared using the Sol-gel Method

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Dimethyl ether (DME) does not contain the poisonous substances, and it burns without particulate matters (PM). DME is expected as a clean fuel for the 21st century [1]. DME is also a good carrier of hydrogen and energy. We have developed the excellent DME direct synthesis catalysts using by the sol-gel method. The Cu-Zn/Al₂O₃ catalysts prepared using the sol-gel method have higher activity and selectivity for DME synthesis from syngas than usual DME direct synthesis catalysts, mixed catalysts of methanol synthesis catalysts and methanol dehydration catalysts [1, 2]. This time, these catalysts are applied for DME direct synthesis from carbon dioxide ($6\text{H}_2 + 2\text{CO}_2 \rightarrow \text{CH}_3\text{OCH}_3 + 3\text{H}_2\text{O}$) for utilization of CO₂, one of the greenhouse gases.

Cu-Zn/Al₂O₃ catalysts prepared using the sol-gel method were used for hydrogenation of CO₂. Each catalyst was used alone, not mixed with an acid catalyst such as alumina. Patented catalyst developed by Kansai Electric Power Co. (KEPCO) & Mitsubishi Heavy Industries (MHI); one of the mixed catalyst of methanol synthesis catalyst and methanol dehydration catalyst; CuO-ZnO-Al₂O₃-Ga₂O₃-MgO (100:25:15:5:1) & Al₂O₃-ZrO₂ (100:10) was prepared depending on the patent [3]. The reactions were carried out with pressurized fixed bed reactor, and the usual reaction pressure was 0.9 MPaG (absolute pressure 1.0 MPa). Reactant gas flow was H₂/CO₂/Ar=15.0/5.0/2.0mlmin⁻¹, and catalyst weight was 0.5g. Online gas chromatographs (TCD, FID) were used for the analysis of reactants and the products, and Ar gas was used for the internal standard gas.

First, we checked the influence on DME production activity by Cu loading percent in Cu/Al₂O₃ catalysts prepared using the sol-gel method. The Cu (30 wt%)/Al₂O₃ catalyst produced DME fastest among the all Cu/Al₂O₃ catalysts. It is speculated that 70 wt% of Al₂O₃ in the catalyst leads the best composition ratio of Cu(active sites for methanol synthesis)/Al₂O₃(active sites for methanol dehydration). Therefore, the Al₂O₃ percent in the Cu-Zn/Al₂O₃ catalysts prepared by the sol-gel method was kept 70 wt%, and several Cu-Zn/Al₂O₃ catalysts that had different ratios of Cu/Zn were prepared using the sol-gel method. The catalysts were tested for CO₂ hydrogenation respectively. The Cu-Zn(15-15 wt%)/Al₂O₃ catalyst produced DME fastest among the all Cu-Zn/Al₂O₃ catalysts. The maximum of DME selectivity is 14 C.%. Under the reaction temperature of 160°C, CO production was reduced and DME selectivity became larger, and the biggest value was 65.8 C.% by the Cu-Zn(15-15 wt%)/Al₂O₃ catalyst. On the other hand, the DME production rate became slower with 15 μmolg_{cat}⁻¹h⁻¹, and its rate was less than 1/3 of the DME production rate under 180°C, 200°C, and 220°C. However, these data are much better than those by the patented catalysts developed by KEPCO & MHI [3]. Cu-Ga/Al₂O₃ catalyst is also moreactive for DME synthesis than the KEPCO catalysts (Cf. Fig. 1). We have developed the excellent catalysts for DME direct synthesis from CO₂ using the sol-gel preparation method.

[1] K. Takeishi, *Biofuels*, 1, 217-226 (2010).

[2] K. Takeishi, et. al, Japan Patent No. 41303069, No. 4506729, etc.

[3] M. Hirano, et. al., Japan Patent No. 4467675.

Keywords: dimethyl ether (DME), catalysis, hydrogen carrier

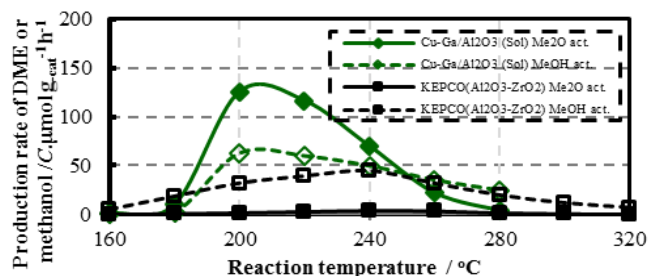


Fig.1 Production rate of DME or methanol by CO₂ hydrogenation over the Cu-Ga/Al₂O₃ catalyst or the KEPCO & MHI catalyst.





Antifungal Activity of *Mangiferaaltissima* Blanco Extract Against *Colletotrichumgloeosporioides* Penz. and Sacc.

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‘Paho’ mango (*Mangiferaaltissima* Blanco) is an underutilized fruit in the Philippines. Unlike its close relative ‘Carabao’ mango (*Mangiferaindica* L.), anthracnose has not been reported yet on the fruit. The study was done to evaluate the potential of dichloromethane extract from *M. altissima* peels as natural fungicide against the causal organism of anthracnose of mango, *C. gloeosporioides*.

Peels of *M. altissima* was separated from the pulp, air-dried and ground. The yellow brown powder was soaked in dichloromethane for one week producing a greenish brown solution. The crude extract was fractionated using open column chromatography producing six fractions. On the other hand, different isolates of *C. gloeosporioides* were collected from diseased ‘Carabao’ mangoes. The most aggressive, as determined by pathogenicity test, was from Davao mango and was used for the assays. The identity of the isolate was further confirmed using morphological and cultural characterization.

The antifungal activities of the crude extract and the fractions were determined using bioautography on thin layer chromatography (TLC) plates. The crude extract and Fraction E showed activity against the test fungus with minimum inhibitory concentrations (MIC) of 800 ppm and 200 ppm, respectively. These results indicate that the extracts have a potential to control postharvest mango anthracnose.

Keywords: mango, *Colletotrichumgloeosporioides*, bioautography





Bimetallic Aluminum Complexes Supported by Methylene Bridged Bis (phenoxy-imine) Ligands for the ROP of *rac*-lactide

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Nowadays, polylactide (PLA) is the most well-known biopolymer and has received great interest because of its biodegradable and biocompatible properties. PLA can be hydrolyzed back to the original lactic acid both *in vivo* and *in vitro*. In this work, bimetallic aluminum complexes bearing methylene bridged bis(phenoxy-imine) ligands were successfully synthesized. The proligands **1** and **2** were prepared by the reaction between 2-*tert*-butyl aniline and the appropriate 5,5'-methylene bis(salicylaldehyde) in ethanol. Treatment of the ligand with 2 equivalents of trimethyl aluminum in toluene at 110°C yielded the corresponding bimetallic aluminum complexes (**3** and **4**) in good yields. All complexes were characterized by ¹H and ¹³C NMR spectroscopy. The ring-opening polymerizations (ROPs) were carried out at 70 °C in toluene. In the presence of benzyl alcohol, all complexes were found to be effective catalysts toward ROP of *rac*-LA in a well-controlled manner. Gel Permeable Chromatography (GPC) analyses revealed that the molecular weight of PLAs were closed to the calculated values and the PDIs were relatively narrow (1.09-1.23). Kinetic studies showed that the presence of *ortho* substituents on the phenoxy rings resulted in a slow polymerization rate. The microstructures of PLAs prepared by **3** and **4** were determined by homonuclear decoupled ¹H NMR spectroscopy. Both complexes were found to furnish atactic PLAs.

Keywords: aluminum complex, ring-opening polymerization, lactide, polylactide





Synthesis of Ag-Doped ZnO by Low Temperature Method

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ZnO and Ag-doped ZnO photocatalyst were prepared by Low temperature method which adapted hydrothermal method at pH 10, 12 and 14. The prepared photocatalyst were characterized by XRD, DRS UV-Vis, SEM and TGA. The XRD indicated that the prepared photocatalysts were in Hexagonal wurtzite with the crystallize size of 25.5 to 37.1 nm. The band gap energy of the photocatalysts which determined by DRS UV-Vis spectrophotometry were between 3.07 and 3.20 eV. SEM indicated that the morphology of ZnO were to flower-like, hexagonal structure and cabbage-like depend on the prepared condition. Ag doped to ZnO had effect on the surface basicity of the photocatalyst. The ZnO prepared at pH 14 had the highest efficiency on the degradation of Acid orange 7 and Basic blue 41.

Keywords: Photocatalytic, photocatalyst, Ag-doped ZnO





Quercetin methylether stimulates melanogenesis *via* inhibiting lysosomal degradation of tyrosinase in B16 melanoma cells

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4'-*O*- β -D-glucopyranosyl-quercetin-3-*O*- β -D-glucopyranosyl-(1 \rightarrow 4)- β -D-glucopyranoside (**1**) was isolated from *Helminthostachys zeylanica* root extract and synthesized as an intracellular melanogenesis stimulatory compound. Synthesized 3-*O*-methylquercetin (**2**) and 3',4',7-*O*-trimethylquercetin (**3**) increased extracellular melanin content more potently than the positive control. Compounds **2** and **3** elongate cell shapes and reduce EPI64 expression in B16 melanoma cells that inactivates the melanin transportation on actin filament. Furthermore the contents of p38MAPK, p-p38MAPK, MITF and melanogenic enzymes in B16 melanoma cells were determined by western blot analysis. The results suggested that **3** increases the melanogenic enzymes contents by stimulating phosphorylation of p38 which increases MITF, a transcriptional factor of melanogenic enzyme. On the other hand, **2** increased melanogenic enzyme without involved in p38 path way and MITF expression. This result suggested that **2** may inhibit the degradation of melanogenic enzymes which result in stimulating the melanin biosynthesis.

Hence in order to elucidate the mechanism underlying the observed activity, tyrosinase contents were determined in B16 melanoma cells treated with cycloheximide, a tyrosinase synthesis inhibitor. As the result, tyrosinase was degraded in control cells by lysosome and/or proteasome to 37% comparing to cycloheximide untreated cells. On the other hand the tyrosinase contents was 67% in the cells treated with **2**, suggesting **2** inhibited the degradation of tyrosinase. Moreover, in order to clarify the further mechanism whether **2** inhibits lysosomal or proteasomal degradation, proteasome inhibitor MG132 was used on the assay. In the cells treated with **2** the degradation of tyrosinase was completely inhibited by MG132 which indicated that lysosomal degradation of tyrosinase was not occurred by **2**. As the conclusion in this study, **2** inhibited lysosomal degradation of tyrosinase which elicits melanogenesis stimulation.

Keywords: tyrosinase; methylquercetin; melanin





Isolation and identification of ingredients in Grains of paradise (*Aframomum melegueta*)

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Aframomum melegueta known as Grains of paradise (GP) is a tropical perennial herb distributed in West Africa. The seeds have been traditionally used as spice or medicine in Africa. In a previous study the oral administration of GP extracts increases expenditure in whole human-body energy and antimicrobial activity for various bacteria. In this study we tried to isolate and identify ingredients in GP seeds in order to investigate bioactivity of the components.

Dried GP seeds powder (296.1g) was extracted with methanol. The methanol extract was sequentially extracted with hexane, ether, ethyl acetate and methanol. Hexane soluble part was separated by silica gel column chromatography (ethyl acetate: benzene = 1: 3) and obtained 4 fractions (HFr.1-4) via TLC analysis. Ether soluble part also separated by the same method and obtained 5 fractions (EFr.1-5). Compound A-J were isolated from HFr.1-4 and EFr.1-5 using preparative high performance liquid chromatography (PHPLC) with reversed phase column. Isolated compounds were identified by ^1H -, ^{13}C -NMR and MALDI-TOF-MS.

The results of ^1H -, ^{13}C -NMR and MALDI-TOF-MS suggested that all compounds had vanilloid moiety and different alkyl side chains (C_8 - C_{12}). Among the isolated compounds, compound C and J were identified as new vanilloid 1-(4'-hydroxy-3'-methoxyphenyl)-undecan-3-ol and 1-(4'-hydroxy-3'-methoxyphenyl)-3-octen-5-one, respectively. On the other hand, acetyl-6-gingerol (E), 1-(4'-hydroxy-3'-methoxyphenyl)-5-methoxydodecan-3-one (F), 1-dehydrogingerdione (H) and 1-(4'-hydroxy-3'-methoxyphenyl)-5-methoxydecan-3-one (I) were firstly isolated from GP seeds.

Keywords: spice, Grains of paradise, vanilloid





Synthesis of the BMPO Spin Trap Using L-proline as a Precursor

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5-Tert-butoxycarbonyl 5-methyl-1-pyrroline N-oxide (BMPO) is one of the nitron spin trapping agents for detecting free radicals. BMPO reacts with free radicals to form long-lived radical adducts which are subsequently detected by Electron Spin Resonance Spectroscopy (ESR), an effective method for measuring and characterizing free radicals. Recently, the synthesis of BMPO was reported to be accomplished in six steps using *tert*-butanol and 2-bromopropionyl bromide as starting materials. Herein, we report a shorter synthetic route designed to be done in five steps using L-proline as a precursor. The structure of the product is confirmed by spectroscopic methods such as NMR and HRMS and the synthetic results will be discussed.

Keywords: BMPO, L-proline, Spin trap





Ring-opening polymerization of *rac*-lactide utilizing aluminum complexes supported by phenoxy-azo ligands

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The aim of this study was to synthesize aluminum complexes supported by phenoxy-azo ligands. Ligands (**L₁H** and **L₂H**) were prepared by azo coupling of substituted phenol derivative and the corresponding diazonium salt. Reactions of trimethylaluminum with the corresponding phenoxy-azo ligands in the molar ratio of 1:1 and 1:2 yielded four-coordinate aluminum complexes (**1a** and **2a**) and five-coordinate aluminum complexes (**2b**), respectively, in good yields. However, attempts to synthesize complex **1b** were not successful. All synthesized complexes were characterized by ¹H and ¹³C NMR spectroscopy. The polymerizations were carried out in toluene at 70°C. In the presence of benzyl alcohol, complexes **1a**, **2a** and **1b** were active catalysts for the *rac*-lactide polymerization. The molecular weights and PDI values of polymer samples were analyzed by Gel Permeable Chromatography (GPC) measurements. All polymer samples prepared by all complexes have molecular weights closed to the theoretical values and narrow PDIs. Homonuclear decoupled ¹H NMR spectroscopy analyses revealed that all polylactides prepared by **1a, 2a** and **1b** were atactic. Kinetic studies demonstrated that first order in monomer was observed in all cases. In addition, the activation energies (*E_a*) of the polymerizations mediated by **2a** and **2b** were investigated.

Keyword: Polylactide, Ring-opening polymerization, Aluminum catalyst





Measurement of Ions in Solution by a Prepared Electrode

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Sulfide ion (S^{2-}) is a toxic species that can be found in natural water and waste water. High concentration of sulfide ion is due to accumulation of rotten aquatic organisms. In this work, a potentiometric electrode was used to measure sulfide ion in solution, an intercalation compound in bentonite, $[Ca-(2,2'-bipyridine)_3]^{2+}$ -bentonite was used as sensing material. Graphs of $\log[S^{2-}]$ vs measured potential (mV) gave linear range at 1×10^{-4} to 5×10^{-2} M of sulfide with slopes agreed Nernst equation. The electrode has good reproducibility, durability and precision. It could be used to measure sulfide ion in water samples with satisfactory results.

Keywords: Potentiometric electrode, Intercalation compound, $[Ca-(2,2'-bipyridine)_3]^{2+}$ -bentonite





Probing the mechanism of imipenem translocation through OccD1 membrane protein from *P. aeruginosa*: Simulation studies

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OccD1 protein is the substrate-specific outer membrane channels found in gram-negative *P. aeruginosa* which are known as an opportunistic human pathogen responsible for many hospital-acquire infections. OccD1 protein acts as a key entryway for positively charged amino acids and importantly antibiotics, especially those from carbapenem family. In this study, Molecular Dynamics (MD) simulations were performed to understand the permeation mechanism of imipenem, one of a potential drug in cabapenem family, in atomic level. MD simulations of wild type OccD1 was also conducted as a reference. RMSD and RMSF indicate the insignificant difference in structural properties. Results also reveal the key interactions between imipenem and protein. Imipenem appears to hydrogen bond to and R130, L131, and F132, respectively.





The use of a Pt (II) complex in Sensor Film for Dissolved Oxygen in water

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This research was a study of using an inorganic complex PtOEP (Platinum(II) 2,3,7,8,12,13,17,18-octaethyl-21H,23H-porphyrin) in a sensor film to measure dissolved oxygen in water (DO) by luminescence technique. Two types of coumarin, (abbreviated as coumarin B and coumarin C) were added to PtOEP. It was found that, film with coumarin B gave better sensing character of PtOEP than a film with coumarin C or without coumarin. Graphs plotting between I_0/I and %DO gave straight line which agree Stern-Volmer equation. The sensor film could be used to measure DO in synthetic DO-water samples and the experimental data was used for simulation study to explain the fluorescence process of the sensor film.

Keywords: Coumarin, PtOEP, Dissolved oxygen sensor, Luminescence





Synthesis of Indolo[1,2-*a*]quinoline via Aromatic Nucleophilic Substitution

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Indolo[1,2-*a*]quinoline(**3**) is a class of indole compounds that can be found in biologically active natural products and semiconductors. This compound can be synthesized from 2-methylindole derivatives (**1**) and 2-fluorobenzaldehyde (**2**) in the presence of Cs_2CO_3 as a base. This is a one-pot synthesis through a cascade reaction of intermolecular aromatic nucleophilic substitution and intramolecular Knoevenagel-type condensation. It is important that the indole substrate has an electron-withdrawing group at C3 to make the reaction happen. Currently, we are working on installation of various electron-withdrawing groups in order to study their effects on the reaction yield.

Keywords: Indolo[1,2-*a*]quinoline, Aromatic nucleophilic substitution





Total Synthesis of Anti-HIV Waltherione C

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Walterione C was isolated from *Melochiaodorata*, which is a plant found in Papua New Guinea. This compound has been found to be biologically active against human immunodeficiency virus, HIV. Our objective is to synthesize walterione C from 3-methoxy-2-methyl-1*H*-pyridin-4-one(**1**). The first step was the protection of the NH group to give *N*-Bocpyridione**2**. The next step involve the Michael addition of α,β -unsaturated ketone to form vinyl dihydropyridione**3** followed by regeneration of the double bond to form *N*-Boc-3-methoxy-2-methyl-6-vinylpyridin-4-one (**5**). This compound will then react with 1,3-cycloheptanedione to form a framework of walterione C.

Keywords: Walterione C, anti-HIV, Michael addition





Synthesis of Intermediates for Naphthoquinone Derivatives

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Naphthoquinone is a class of compounds derived from naphthalene. Several naphthoquinone derivatives including naphthoquinone aromatic ester, naphthoquinone aromatic amide, naphthoquinone aliphatic amide, and naphthoquinone aliphatic ester exhibit anticancer activities. All of those derivatives contain a carbonyl group in their chemical structure. In order to explore naphthoquinone derivatives with different functionalities, the naphthoquinone derivative possessing azido group is synthesized via 8-step process. First, 1-hydroxy-2-naphthoic acid was methylated using methyl iodide to obtain methyl 1-methoxy-2-naphthoate (1). Without purification, this compound was then reduced using lithium aluminum hydride to produce 2-hydroxymethyl-1-methoxynaphthalene (2) in 85% yield in 2 steps. Subsequently, bromination of compound 2 with phosphoroutribromide provided 2-bromo methyl -1-methoxynaphthalene (3) in 76% yield. Alkylation of compound 3 with methyl isobutyrate yielded 2-(2,2-dimethyl-3-methylpropanoate)-1-methoxynaphthalene (4) in 79%. Next, compound 4 was reduced using lithium aluminum hydride to produce 2-(3-hydroxy-2,2-dimethylpropyl)-1-methoxynaphthalene(5) in 85% yield. The tosylation of compound 5 using tosyl chloride produced 2-(2,2-dimethyl-3-(4-methylbenzenesulfonyl)-1-methoxynaphthalene (6) in 81% yield. Compound 6 was then treated with sodium azide resulting in 79% yield of 2-(3-azido-2,2-dimethylpropyl)-1-methoxynaphthalene (7). Finally, compound 7 was demethylated using boron tribromide. This compound serves as a key intermediate for the synthesis of naphthoquinone derivatives with triazole and amine functionalities.

Keywords: Naphthoquinone Derivatives, Anti-cancer, Triazole





Photodegradation of Basic blue 41 dye by Ag-doped ZnO which prepared by presipitation method

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The Ag-doped ZnO photocatalysts with 0.5% and 1% mol of Ag loading were synthesized by precipitation method using $\text{Zn}(\text{OAc})_2$, NaHCO_3 and $[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$ as precursors. The prepared photocatalysts were calcined at temperature between 400 to 800°C. The degradation of the photocatalysts for Basic blue 41 was determined under visible light irradiation. The crystallize size of the doped ZnO nanopowder were determined from XRD pattern using Scherrer's equation which were between 14 to 88 nm. The XRD results indicated the increasing in crystallinity and crystallize size of Ag-doped ZnO when the calcination temperature was higher. The band gap energy of the doped ZnO nanopowder were determined from DRS spectrum. The DRS UV-Vis results showed the reducing of band gap energy when the Ag was loaded to the photocatalysts. The results of Scanning Electron Microscope (SEM) indicated only the existence of ZnO in hexagonal wurtzite structure. Under visible light irradiation, 1% Ag-doped ZnO calcined at 500°C had the highest %degradation for Basic blue 41 as 84.3% and rate of constant as 0.6141 h^{-1} . The %degradation and rate of constant are slightly decreased when the photocatalysts were reused.

Keywords: photocatalytic, photocatalysts, Ag-doped ZnO





Genetic Transformation of Potato (*Solanumtuberosum*L.) Cultivar Agria by Using *Hd3a* Gene

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Hd3a is a protein involving in flowering and tuber formation in short day potato cultivar Andigena cultivated in long day condition. This research has an objective to transform genetically the potato (*Solanumtuberosum* L.) cultivar Agria by using *Hd3a* gene under the control of *rolC* promoter. Potato plants were propagated *in vitro* on MS2Macro medium. Genetic transformation was carried out by co-cultivation method by using *Agrobacterium tumefaciens* LBA4404 carrying p2K1-Hd3a plasmid. Internodes of three weeks *in vitro* plants were used as explants for transformation. Selection of transgenic calli, shoots and plants was performed in MS medium containing 10-20 mg/lhygromycin. The results showed that the average of efficiency of transformation was 5.01% with shoot regeneration efficiency was very high, 100%. The regeneration rate of transgenic shoot was one shoot per callus. From 162 internodes transformed by *A. tumefaciens*, we obtained 8 putative transgenic plants. After four weeks in MS2 Macro medium, 62.5% of these transgenic plants produced tubers whereas non-transgenic potato plants did not. This result indicated that *Hd3a* induced formation of tuber of putative transgenic potato cultivar Agria. Until four weeks, none of transgenic and non-transgenic potato plants formed a flower. This result indicated that four weeks is not enough time to induce flower formation for potato cvAgria plants.

Keywords: potato (*Solanumtuberosum* L) cultivar Agria, genetic transformation, *Hd3a* gene, tuber formation





Seed-Borne Fungi of Sorghum

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The objective of this research is to determine the external and internal seed-borne fungi of sorghum seeds and their frequency of occurrence. Seed-borne fungi were detected after 5-7 incubation of disinfected and non-disinfected sorghum seeds on wet blotter set-up. Fungi that failed to sporulate even for more than two weeks of incubation were declared as sterile. Identification of the fungi was based on morphological characteristics alone. Per cent occurrence of fungi on both treatments was noted to account for the nature of fungi either as superficially- or internally-borne, or both.

Total of twelve fungi composed of a species of *Bipolaris*, *Curvularia*, *Fusarium*, *Penicillium*, *Phoma*, *Rhizopus*, and two species of *Aspergillus*, *Chaetomium*, and sterile mycelia producing purely 'enclosures' were recorded. The presence of each fungal species for both treatments varies. Most of the fungal species were present for both treatments of seeds, except *Chaetomium* sp. CRO-TUD05 and *Phoma* sp. CRO-TUD09 that were only found on disinfected seeds while *Rhizopus* sp. CRO-TUD010 and *Chaetomium* sp. CRO-TUD04 on non-disinfected seeds. Per cent occurrence of the species on both treatments varies but with *Curvularia* sp. CRO-TUD04 dominating the samples with 36.08% on non-disinfected seeds and 33.19% on disinfected seeds. Least frequently associated were *Chaetomium* sp. CRO-TUD04 (0.53%) on non-disinfected seeds and *Chaetomium* sp. CRO-TUD05 and *Phoma* sp. CRO-TUD09, both with 0.11% on disinfected seeds.

Most fungal species that are present in disinfected and non-disinfected seeds vary in percent of occurrence. Species of *Curvularia* dominates the seeds and least occurred were *Chaetomium* and *Phoma*.

Keywords: seed-borne fungi, sorghum





Diseases of Selected Imported Fruits in the Philippines

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Fruit sector in the Philippines makes important contribution in food security which involves in Filipino diet. Due to insufficient production and some not domestically produced, the country imports them. Plant Quarantine protects the Philippine agriculture from the entrance and spread of the pathogens from other countries but there are diseases that still manifest. The objective of this research is to account for the diseases of incoming fruits into the Philippines. Fruits from market places showing symptoms were collected and immediately processed in the laboratory. Symptomatic fruits were incubated to let the fungi sporulate and isolation was done to confirm presence of associated fungi.

Eighteen sporulating fungi were associated from different imported fruits. Pathogenicity was performed and fungi that positively infect the fruit were identified. A species of *Alternaria* and *Phomopsis* were found in Fuji apple causing brown rot. Stem-end rot of green apple was due to presence of an Ascomycete. *Penicillium* and *Colletotrichum* produced brown rot lesions in kiatfruit and another species of *Colletotrichum* was found in orange fruit. Imported persimmon fruits were infected by different genera of fungi namely, three species of *Pestalotiopsis* causing sunken rot of brown to black discoloration and two *Colletotrichum* species causing light brown discoloration. *Pestalotiopsis* likewise causes brown discoloration in longan fruit. Brown lesion on pear fruit was produced by a species of *Fusarium* after inoculation. *Cladosporium*, *Aspergillus* and *Alternaria* created brown sunken symptom in grapes.

Brown rot, occasionally sunken was the common symptom observed from eight imported fruits. Most dominant fungi were species of *Colletotrichum* (3), *Pestalotiopsis* (3), and *Alternaria* (2).

Keywords: fruit, fungi, Philippines





Leaf Blight of Coconut (*Cocosnucifera* L.) Caused by *Fusarium* spp., A New Disease Record in the Philippines

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Leaf blight disease on coconut was observed in different growing areas in Batangas and Laguna provinces. A study was conducted primarily to establish the fungal pathogen(s) responsible for the disease and to determine their identity to species level based on morphological characterization and molecular work.

Total of 40 *Fusarium* isolates were obtained from randomly collected coconut leaves showing grayish to brown lesions that coalesce to form blight with dark brown margin. Out of 40 isolates, ten were confirmed causing the disease by satisfying the pathogenicity test on coconut seedlings. Blotter set up utilizing a block of potato dextrose agar (PDA) medium was done to monitor formation of fruit bodies, hence, characterizing the chlamydospores and phialides. The structures were formed in three days. Disinfected carnation leaves (dry and fresh) placed on top of plated WA were used, on the other hand, for heavy formation of micro- and macroconidia. Both spore types were produced at five days of incubation. Spore size (length and width) for both types of conidia were measured on both set-ups. It was observed, however, that spore length of both spore types posed better assessment of size than width due to wider scale of difference between the longest and shortest measurements. On dried carnation leaves, the longest macroconidia were observed from *Fusarium* sp. ADC-I1 (35.88 μm), followed by ADC-I2B (32.68 μm) while microconidia of ADC-I9 have spore length of 7.78 μm . Macrospores of *Fusarium* sp. ADC-I2 obtained the least measurement for length (27.98 μm) while ADC-I4 for microspores with value of 5.45 μm . On fresh carnation leaves, macroconidia of *Fusarium* sp. ADC-I4 and ADC-I7 got the longest measurements, 42.63 μm and 41.28 μm , respectively whereas ADC-I9 got the shortest measurement (24.89 μm). On the other hand, microconidia of *Fusarium* sp. ADC-I11 have a highest value of 7.02 μm while those of ADC-I3 have the lowest value of 5.76 μm . All values are average measurements obtained from fifty spores for each type.

Ten isolates of *Fusarium* caused leaf blight of coconut. Plated medium with carnation leaves either dry or fresh conditions induced formation of macroconidia. Range of length measurements of spores is narrower than width measurements.





Fungal Endophytes of Barnyard Grass and their Probable Role in the Management of Sheath Blight Disease of Rice

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Survey and collection of barnyard grass in lowland rice fields, and laboratory and greenhouse experiments were conducted at Nueva Ecija Province, Philippines to a) identify the fungal endophytes of barnyard grass; b) determine the distribution of each fungal endophyte inside tissues of barnyard grass and in rice field areas of Nueva Ecija; and 3) determine the potential of fungal endophytes of barnyard as biocontrol agents against sheath blight pathogen of rice. A total of 1,570 isolates of fungal endophytes were recovered out of 7,680 tissue samples of barnyard grass. Among the fungal group, hyphomycete was the most dominant comprised of 12 genera. Middle portion of lower leaf blade had the highest rate of colonization in dry season while seeds, lower leaf blades (top, middle, bottom), and the middle and bottom portions of the upper leaf blades. *In vitro* test showed that EF-ds68-129, *Geotrichum* sp. EF-ds104-16 and SM EF-ds375-97 were the only endophytic fungi antagonistic to sheath blight pathogen. Only *Geotrichum* sp. EF-ds104-16 was parasitic to the pathogen. In pot experiment, *Geotrichum* sp. EF-ds104-16 applied as protectant was very effective in delaying the onset and reducing sheath blight development when it was applied at 15 DEFI at 10^3 , 10^5 , and 10^7 spores^{-ml}. EF-DKMDds68-129 applied in 10 and 15 DEFI at 10^3 and 10^7 spores^{-ml} was also effective.

Keywords: Endophytes, barnyard grass, hyphomycete





Fungi Causing Fruit Rot of Roseleaf Raspberry (*Rubus rosifolius* Sm.) in the Philippines

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Roseleaf raspberry (*Rubus rosifolius* Sm.) is a thorny plant that thrives in the Philippines as wild species, however, it is found to be cultivated in Kinabuhayan, Dolores, Quezon. A study was conducted primarily to detect the presence of disease-causing fungal isolates on berries of raspberry and to identify and characterize culturally and morphologically those isolates that are positive for disease infection to the fruits. There were a total of eight fungal isolates previously obtained from diseased berries causing rot. All these isolates were confirmed to cause the disease through the conduct of pathogenicity test on raspberry fruits and degree of rot was assessed using the visual quality rating (VQR) developed by authors. Isolates were grown on different culture media to account for the growth rate and fruit body formation.

Based on morphological attributes of the fruit bodies, the fungal isolates were identified as follows: RF-AFB2, 5, and 6 are from the coelomycetous group while RF-AFB4, 7, 8, and 9 are species of *Fusarium*. RF-AFB3 is tentatively declared as non-sporulating or sterile mycelia (SM) at this point in time. The eight fungal isolates expressed variable degree of rot on the pathogenicity test. RF-AFB3 was the most virulent with VQR of +++ described with profuse, dense mycelial growth covering fully the fruit resulting to severe rot, followed by RF-AFB7, RF-AFB8, RF-AFB2, RF-AFB4 with VQR of ++ showing dense mycelial growth but not fully covering the fruit. Fungal isolates that expressed the least rot with scanty mycelial growth on fruits (VQR of +) were RF-AFB9, RF-AFB6 and RF-AFB5. These isolates were then grown on different culture media to account for the daily growth increment (DGI) and growth rate (GR). After five days incubation, Malt Extract Base Agar (MEA) was found to be the most suitable medium for all the isolates with an average GR of 6.22 mm/day. Isolate RF-AFB2 was most favoured by MEA, followed by RF-AFB4. In summary, all eight isolates caused raspberry fruit rot in various degrees with RF-AFB3 of highest VQR. MEA was most favourable for growth of all isolates as compared with the other media.

Keywords: Fruit rot, Roseleaf raspberry





Conidial Germination and Fruit Body Formation of *Gonatophragmium* sp., the Causal Organism of Red Stripe Disease on Rice, as Affected by Nitrogen and Relative Humidity

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This study described the effects of nitrogen and relative humidity on conidial germination and fruit body formation of *Gonatophragmium* sp. The third and fourth leaves from forty day old unfertilized rice plants and those fertilized with 140 nitrogen level were detached and cut at about 8 cm. Inoculation of spore suspension on detached leaves was done followed by fixing and clearing for observation of germination and fruit body formation. Similar set up was done on effect of relative humidity.

Conidial germination on both treatments began as early as 0.5 hours after inoculation (hai) and reached its maximum at 24 hai for unfertilized while 48 hai for fertilized leaves. Conidia vary widely on their germinability. The length of germ tubes significantly increased through time on both treatments. Germ tubes developed into hypha earlier on fertilized leaves than those of unfertilized leaves. The pathogen's behavior in penetrating its host surface was also characterized as direct and indirect ingress of germ tubes and elongated hyphae on the adaxial leaf surface and stomata. Moreover, unipolar and bipolar germinations were observed more frequently than intercalary germination during its incubation. Significant differences on conidial germination were manifested at different levels of relative humidity over time. Spores subjected to 100% relative humidity level have faster germination rate and produced various modes of germination than those of other levels of relative humidity. Formation of fruit bodies was seen earlier on fertilized leaves at 9 days after inoculation (dai) and developing conidia, after two days.

Percent germination of spores significantly increased through time and was earlier observed on inoculated unfertilized leaves than those of fertilized leaves. There were significant differences in conidial germination of *Gonatophragmium* sp. subjected to various levels of relative humidity. Its fruiting structures on the leaf surface were evident on fertilized leaves at 9 days after inoculation.

Keywords: rice, red stripe, *Gonatophragmium* sp.





Sex identification of Cyclophorid snails using PCR technique

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Cyclophorid snails (*Cyclophorus* sp.) are operculate land snails generally found globally in tropical rain forests and limestone mountains. They are important scavenger which decays plant remains and organic matters into organic compounds absorbable by plants and microbes. According to the history, human and animals have used these snails as nutritional source for decades. Nowadays the Cyclophorid snail population are being threatened to risk of extinction because of human collection, consumption, toxic pollution and deforestation. Although the cyclophorids are dioecious with ZZ/ZW sex determination system, its morphological and chromosomal sex determinations are difficult. Breeding this snail remains problematic since the male and female breeders are hard to differentiate. This study aimed to develop a non-killing sex identification method for the Cyclophorid snails by using polymerase chain reaction (PCR), nucleotide sequencing and bioinformatics analyses. PCR primers specific to DM domain were designed based on conserved regions of the DM domain-containing proteins, such as doublesex (Dsx) proteins of other animal species available in the protein database. Genomic DNAs of sex-identified cyclophorid snails were extracted and screened using the designed primers. The authors are currently optimizing the primers and PCR conditions. Our developed method will provide rapid and accurate method for sex identification of these snails. Moreover, the results could benefit further effective large-scale cyclophorid snail breeding.





Effects of Gamma Radiation on *Aloe vera* Growth and Chromosome Structure Banding Pattern

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Aloe barbadensis Miller or *Aloe vera*, is an ornamental plant grown widely in Thailand. Besides unique plant structure, it has many usages such as first aid treatment from burn caused by fire or hot water, skin treatment for eczema and psoriasis, or an ingredient in energy drink of dessert. The current study was conducted to see the effects of gamma radiation on *A. vera* growth under sterile condition and any changes in the chromosomes that might occur. *A. vera* plantlets were exposed with acute and chronic gamma ray at 0, 1, 2, 3, 4 and 5 krad to determine their responses. Percentages of plantlets turning yellow brown and died increased with the dosages of radiation. The LD50 values determined from regression analysis based on percentage survival in tissue culture media was 1.73 krad for acute radiation and 2.44krad for chronic radiation. Karyotype of normal *A. vera* plant was studied using root tip by lacto-aceto-orcein squash preparations. The diploid chromosome number was found to be $2n = 14$ with four pairs of long submetacentric chromosomes and three pairs of short submetacentric chromosomes.





Identifying the structure of *Vitellogenin* from giant water bug (*Lethocerus indicus*)

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Giant water bug, *Lethocerus indicus* is one of the largest insects distributing worldwide. Their body length can be up to 12 cm. The insects belong to the family *Belostomatidae*, Suborder *Heteroptera* and Order *Hemiptera*. *L. indicus* is the native giant water bug of Southeast Asia. In Thailand, people have used the male bug as an aromatic ingredient in some native curry pastes. In this study, the structure of *Vitellogenin* (*LiVg*) gene, an egg yolk precursor protein for embryonic development, of *L. indicus* is identified. To obtain its structure, the complete *LiVg* genomic sequence is aligned with the full length *LiVgc* DNA sequence to obtain the number and the length of exons and introns of *LiVg* gene.





Near-Isogenic-Lines (NILS) Genome Scanning For Rice Blast Resistance Gene

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Rice blast caused by a fungus, *Magnaporthe oryzae*, had a capability to create severe damage to the rice field and reduced rice production. There are many methods to protect rice crop from rice blast, but one of the most effective way and environmental friendly is by using rice blast disease resistance varieties. In order to create disease resistant varieties without sacrifice too much desirable trait from conventional breeding, Near-isogenic-lines (NILs) can be a powerful tool for breeding program to preserve most of genetic content with few changes and adding disease resistance trait. Three NILs of KDML105 genetic background and IR64 resistance gene donor with rice blast resistance trait were selected: 56-1, 47-2 and 2-3. Genome scanning perform by using polymorphic SSR and InDel Markers to determine the genetic material of each lines. The results show that line 56-1 and line 47-2 inherit high genetic material from KDML105 and minimal from IR64 while line 2-3, contain high amount of genetic material from IR64, This result indicate that line 56-1 and line 47-2 could be used for breeding program for rice blast disease resistance trait.





Recent Advances in Nano-materials for Energy and Environmental Remediation

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In the last decade, nanoparticles have emerged as the new building blocks to fabricate light energy harvesting assemblies, storage devices and environmental application studies. Among the different nano-structured materials, semiconductor nanoparticles that exhibit high efficiency towards photocatalytic processes have been synthesized using various simple methods including sol-gel, hydrothermal, precipitation, etc. Size dependent properties of semiconductor nanomaterials provide the basis of developing new and effective catalytic assemblies. With the various available semiconductor materials, TiO_2 and TiO_2 based visible light photocatalysts have been widely used as potential photocatalysts for both energy and environmental application studies i.e. complete decomposition of organic pollutants into carbon dioxide and water, an additive in polymer solar cells for fast transport of electrons and thereby increasing the efficiency, photoanode material for enhanced charge collection in dye-sensitized solar cells, splitting of water to produce hydrogen (solar fuel), etc. Similarly, metallic nano-particles have been synthesized and effectively used in storage devices such as lithium ion batteries to enhance the storage capacity as well as durability. Further, different solid supports such as carbon nanotubes (CNT), graphene oxide, zeolites are used to enhance the catalytic properties of the catalysts, increasing storage capacity, reduce the reaction time and the amount of the catalysts as well. Among the different supports, recently, reduced graphene oxide is widely used as a potential solid support for various application studies including electronic devices due its high electron transport capability and storage capacity, high surface area, mechanical stability, easy method of preparation and cheap. The recent progresses and suitable examples will be discussed along with the future outlook from global perspectives.

Keywords: solar cell, photocatalysis, fuel cell, degradation





Expression of genes coding LTB and CTB antigens in higher plant

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The cholera toxin B subunit (CTB) from *Vibrio cholerae* and the heat-labile enterotoxin B subunit from *E. coli* (LTB), nontoxic molecules with potent biological properties, are powerful mucosal and parenteral adjuvant that induces a strong immune response against co-administered or coupled antigens. Genes encoding CTB and LTB, which were modified based on the optimized codon usage in the plant, were synthesized and fused to the endoplasmic reticulum retention signal KDEL to enhance their expression levels in plants.

The synthetic CTB (sCTB) and synthetic LTB (sLTB) genes were introduced into plant expression vectors (pMYO51 and pMYO53) adjacent to the CaMV 35S promoter, and were transformed into some crop plants (tomato, watercress, tobacco, and *Peperomia pellucida*) using an *Agrobacterium* mediated- or biolistic transformation method.

The integration of the sCTB and sLTB genes into the genomic DNA of transgenic plants was confirmed by PCR amplification of genomic DNA or Southern blot. The synthesis and assembly of CTB and LTB proteins in transgenic plants was demonstrated through immunoblot analysis and GM1-ELISA. The highest amount of CTB and LTB proteins produced in transgenic plants were approximately 0.8-1.5% of total soluble fruit protein which were about 10-fold greater than the previously reports. GM1-ELISA indicated that plant-synthesized CTB and LTB proteins bound specifically to GM1-gangliosides, suggesting that the CTB and LTB subunits formed active pentamers./.





SHALLOT DISEASES IN INDONESIA

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ABSTRACT

Shallot (*Allium cepa* group *aggregatum*) is one of 2 prioritized vegetables together with chili in Indonesia. There are several shallot production centers in Indonesia mostly in Java located in West, Central, Jogja Special Province and East Java with twice or three times planting seasons a year. This research is conducted mostly in Jogja and East Java shallot production centers under the ACIAR project of HORT 2009/056.

Fungal diseases were found including *Fusarium* spp and *Alternaria porii* as the main pathogens distributed in all areas, *Colletotrichum* sp. and *Stemphylum* sp. were found in Jogja. Diversity of *Alternaria porii* was found based on rep-PCR DNA profiling. *Fusarium* diseases with wilt or leaf tweested symptom is associated with *F. acutatum* and *F. solani*, basal rot is associated with *F. solani*, *F. oxysporum* and *F. acutatum*. *Fusarium* disease complex incidence is up to 60% in rainy season but it is much lower incidence in dry season less than 30%. Bacterial diseases were found and identified as *Pectobacterium carotovorum* the causal agent of bulb soft rot, however the disease was also found to be associated with *Strenotophomonasmalthopilla* and *Enterobacter cloacae* with weak symptom of soft rot. The antagonistic assay of *S. malthopholia* and *E. cloacae* against *P. carotovorum* did not show any positive results suggested that those 2 bacteria may support to accelerate or increase the soft rot intensity. *Pantoea ananatis* was also found limited in some shallot production areas, however the bacterium is a quarantine pathogen wich is supposed to be protected to introduce to Indonesia.

Virus diseases were also found mostly in the groups of Potyvirus and Carlavirus, whereas Alexivirus was found with limited incidence. The incidence of Potyvirus on the local varieties of shallot in dry season is about 50% and in rainy season is higher than 60%, whereas Alexivirus was found only 2-6%. Those viruses are transmitted from season to the next season due to bulb seed is used as planting material. True Shallot Seed (TSS) has been started to be developed, however it is not yet available for the farmer's supply, and most farmers consider that using TSS is too laborious. The authority of institute(s) has been trying to produce bulb seeds from TSS, however, there is very insufficient supply due to several constrains in TSS production. The production of shallot in Indonesia is with the average of 10 ton/h which is only about a half from the potential yield. Beside diseases as the production constrains, lack of bulb seeds is usually occurred and not sufficient for the demand of planting materials in the early dry season due to low production of shallot during rainy season. Special strategy is needed to develop shallot cultivar(s) suitable and disease resistant to be planted during rainy season.

Key words: Shallot onion, disease constrains.





Dark matter constraints from AMS02

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According to the data from Cosmic Microwave Background, we found that a quarter of the Universe consists of dark matter. However, the properties of dark matter are still a big problem in cosmology and particle physics. Dark matter can be interacted by the gravitational force and only have weakly interaction with the weak force. There is no interaction with the electromagnetic force and the strong force. We can measure the amount of dark matter precisely from gravity but the properties of dark matter particles remain a mystery.

The properties of dark matter particles can be investigated by particle accelerators, direct detection and indirect detection. The direct detection is based on the assumption that if the universe is filled with dark matter, the Earth must be moving through the flow of dark matter. Since dark matter particles could have the weak interaction with the standard model particles, the dark matter particles will collide with the nucleus of elements and the nuclear recoil should be detected by a detector on Earth. However, the particle accelerators and the direct detection have not found any dark matter.

Fortunately, we can also determine the properties of dark matter by the indirect detection which is based on the assumption that dark matter and anti-dark matter can annihilate into the particles which we can detect such as electrons, positrons, protons, antiproton, neutrinos and photons. The properties of dark matter particles can be predicted by the properties of these productions.

This work focuses on the astrophysical signatures of dark matter annihilation into electron–positron pairs, neglecting other processes, such as dark matter decay, or other annihilation products, such as protons and antiprotons. These electrons and positrons are moving through the Galaxy and lose their energy from various processes in the Galaxy. We try to impose robust, yet stringent constraints on the relevant cross-section by comparing the predictions of an analytic model of particle propagation with the electron-positron spectrum at the solar neighborhood obtained from AMS02 which is a detector fixed at the International Space Station. The results yield a significant improvement on the maximum value allowed for the electron- positron injection rate or, equivalently, the dark matter annihilation cross-section.





A Second-Quantization Approach to the Analytical Faraday Effect in Graphene

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We investigate coherent single photon traveling in the positive z direction passes through a graphene film subjected to a transverse magnetic field B . Analytical expressions are obtained for the transmission and reflection coefficients by full second-quantized form. Giant Faraday rotations in the infrared regime are generated and measurable Faraday rotation angles in the visible range become possible. For an example, this explains the departure from the semiclassical value for θ_F observed in the right panel in $B \approx 1$ T for $\hbar\omega = 10$ meV ($B \approx 0.5$ T for $\hbar\omega = 30$ meV). If the magnetic field intensity is higher than a given value, we necessarily have $N_F = 0$ (for 0.05 eV this value is about 1.9 T). In this case, the Hall conductivity at $T = 0$ is fully determined by a single type of interband transition, and assuming $E_1(B) \gg \hbar\omega$, we obtain $\theta_F \approx 3 \times 10^{-4}$.





Comparison and Verification of Different Cumulus Parameterization Schemes in Short Range Rainfall Prediction for Off-Season Heavy Rainfall over Southern Thailand

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In recent years, Numerical Weather Prediction (NWP) plays an important role in short-range rainfall predictions. These can be defined as predictions of no longer than one week in advance. The atmospheric physical parameters have been continuously developed for the NWP. These parameters are implemented into NWP models based on equations derived from theoretical assumptions based on observations and physics of the event. On this respect, physics of clouds gives rise to various equations for implementation of parameters into the NWP. These various methods of implementation are called Cumulus Parameterization schemes (CP). The choice of CP scheme used has to be properly chosen based on both the type of forecast and the forecast location.

This study investigates the use of two CP schemes, namely, Grell-Freitas (GF) and Grell-Devenyi (GD), in the version 3.5.1 of Weather Research and Forecasting (WRF) model. The study focuses on heavy rainfall caused by cold surge and near-equatorial through during the pre-monsoon (March-April) of 2011, 2012, and 2013 in the east coast of southern Thailand. The rarity of the heavy rainfall during the pre-monsoon makes it an appealing object of investigation.

Using the initial conditions preceding the heavy rainfall events, 24, 48, and 72 forecasts were simulated using the WRF with two different schemes. The performance of the schemes was measured by the comparison with observed rainfall data from Tropical Rainfall Measuring Mission (TRMM) and Thai Meteorological Department.

The result shows that both schemes overestimate the rainfall amount with the forecast from the GD being higher than that of the GF scheme. The statistical indicators used to compare the performance of the two schemes include hit rate, critical success index (CSI), equitable threat score (ETS), and POD CSI. All the statistical indicators support the finding that the GF scheme has a higher performance than the GD scheme when used in off-season rainfall forecasts over the east coast of southern Thailand.





Stratigraphy and Depositional Environment of Neon PhuYaiYua Formation, Thamai District, Chantaburi Province

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The Neon PhuYaiYua Formation, deposited during Triassic, has been mostly exposed in Chanthaburi Province along the northwest-southeast direction. Here, we study 4 outcrop of the Neon PhuYaiYua Formation in Thamai District, Chanthaburi Province. The main approaches are lithostratigraphic and vertical stacking pattern analyses. Based on field study, the Neon PhuYaiYua Formation is divided into four lithofacies : medium to very thick bedded sandstone, sandstone interbedded with laminated to very thin mudstone, sandstone (Ta) and siltstone to mudstone (Td/Te) of Bouma sequence, shale and mudstone. The four lithofacies can be grouped into three major genetic units: channel-levee complex, proximal lobes and distal lobes. It could be interpreted that the Neon PhuYaiYua Formation represents mid-fan deposits of submarine fan depositional environment.





Carbon dioxide sequestration by mineral carbonation reaction using basalt at Den Chai District, Phrae Province

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The rising of greenhouse gases, especially carbon dioxide, lead to the climate change issue that becomes the significant problem in the present. There are many way to decrease carbon dioxide – mineral carbonation is the one. The research was carried out in order to study the feasibility of mineral carbonation using Den Chai basalts. The procedures in this research consisted of studying composition in the samples before reaction, experiment of reaction between basalt and CO₂ in autoclave reactor, and proving the results after reaction. The basalt samples were collected from Den Chai District, Phrae Province. Then, they were studied their texture, mineral composition, and chemical composition by polarizing microscope, XRD and XRF respectively. After that, the sample had been reacted with CO₂ in autoclave for 8 days under the condition 50°C and 60 bar CO₂. Finally, the reacted sample was proven by XRD and SEM to find some new minerals on its surface. According to XRD result, the samples composed of forsterite, pyroxene, plagioclase, and magnetite and XRF result suggest the chemical composition of basalt with 45-50% SiO₂, 1-3% TiO₂, 15-17% Al₂O₃, 8-12% Fe₂O₃, 5-10% MgO, 6-9% CaO, 2-5% Na₂O, 0-3% K₂O, 0-1% P₂O₅, and 0-1% MnO. Then, the sample had been reacted with CO₂ for 8 days. After that, the reacted sample was proven by XRD. The result shows mineral siderite (FeCO₃) instead of magnesite (MgCO₃). Consequently, Den Chai basalts can capture CO₂ to form carbonate mineral.





Development and Application of Resistivity Instrument for Borehole: Case Study to Locate of Gas Pipe Line with Imaging and Cross Borehole techniques

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Borehole resistivity measurement was applied to locate gas pipe line where is situated at the same place of the foundation of the expressway construction. The study area is located close to Taling Chan junction railway station in Chimphil Sub district, Taling Chan District, Bangkok (656030E/15246220N). The geological setting is found as a Quaternary Bangkok clay (20 m depth) which consist of top clay (1-4.5m), soft clay (5-10m) and stiff clay (5-10m) and the layer of sand(40-50 m thick). Two boreholes are set crossing between gas pipe line position with 3 m separation and 50 m depth. Two new designed water-proved multi-cables of 30 electrodes with 1 m spacing were applied for resistivity measurement inside both boreholes. Technically, two measuring procedures were applied 2D vertical resistivity imaging in each borehole by using DP-DP and Schlumberger arrays. Then cross borehole resistivity measurement was taken by DP-DP and P-DP array with setting remote electrode, C_2 at distance of 100 m apart. The result shows the location of gas pipe line is slightly high resistivity comparing to the environment of clay layer presenting very low resistivity ($< 2\Omega\text{m}$). 2D vertical section imaging displays the location of gas pipe line at the depth about 30.5 m which is slightly different from cross borehole section showing at the depth about 32 m. The water proved multi-cable and techniques of imagine and cross borehole can be applied to determine the position of gas pipe line. The cross borehole technique is clearly able to indicate the position of gas pipe line.





Hydrological Characteristic Study of Kui Mang Watershed, Thongphaphum, Kanchanaburi Province

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The study of hydrological characteristic of Kui Mang Watershed, Thongphaphum, Kanchanaburi Province is consist of climate and hydrograph analysis of 10 years (2005–2014), data used is 3 hourly rainfall, water level and discharge from hydrological station K60 (Ban Kui Mang, Thongphaphum). Kui Mang Watershed has important tourist attraction (Hindad Hot Spring) that beside a stream.

The results show that Kui Mang Watershed has a wet period on April to November, and dry period on January to March. The daily rainfall analysis indicate which is very heavy rain (>90.1 mm.), It has 6 events. It is period between July and September, this period is a rainy season. In addition, the maximum daily rainfall is 135.9 mm. in July that caused by strong southwest monsoon. However, the maximum daily rainfall from thunderstorm in March and May are 84 and 87.6 mm. respectively. The hydrograph and unit hydrograph analysis, it indicate that if Kui Mang Watershed has one storm which can create direct runoff, lag time of peak flow is about 15 hours. For the complex storm will affect to basin lag time of peak flow is about 7 hours. This study will help to estimate duration and maximum water level in Kui Mang Watershed, and plan for flood warning.





Petrography and chemical properties of limestone at Khao On, KaengKhoi District, Saraburi Province

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Limestone of Saraburi Province has an economic importance as it is widely used for construction. Here, we analyze 10 (hard and pure) samples of limestone at Khao On, KaengKhoi District, Saraburi Province. They are classified with a polarized light microscope and their major chemical compositions are quantified with an X-ray fluorescence (XRF) spectrometry. The petrographic study can separates Khao On limestone into 5 lithologies: micrite, unsorted biosparite, sorted biosparite, poorly washed biosparite and sparse biomicrite. The XRF results show that the average amounts of CaO, MgO and SiO₂ are 76.663, 1.948, and 3.563 percent by weight, respectively. Therefore, Khao On limestones are high quality and appropriate to be utilized in several, key industries of Thailand, such as cement, building materials and ceramics.





Optimizing Sudoku X Using Artificial Bee Colony Algorithm

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Sudoku has become popular puzzle in the world. It influences the emerging of Sudoku variety like Sudoku X. Rule of Sudoku X is the same with standard Sudoku puzzle with an additional rule: the two diagonals of the puzzle board must contain each digit from 1-9 exactly once. As the standard Sudoku puzzle, Sudoku X has a lot of possible combination of the solution. Artificial Bee Colony for Sudoku solver has been proven to be successful in optimizing the standard Sudoku solver and outperformed other algorithms in terms of time and cycles needed. The Sudoku X puzzle generated in three levels: hard, medium and easy. The result of this research shows that Artificial Bee Colony Algorithm can find the optimal solution for Sudoku X with average accuracy of 86.66%. The accuracy is influenced by the number of employed and on looker bee used. Increasing number of employed and on looker bee results in better solver accuracy.

Keywords: Sudoku X, Artificial Bee Colony, Optimization Algorithm





Bounce Game Application on Leap Motion Controller

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“Bounce” is an interactive arcade game presenting the new way of playing game by using hands and gestures instead of mouse and keyboard. Bounce runs on both Windows and Mac OS connected with Leap Motion Controller, a motion sensing device. The main character of the game is a hamster, bouncing around on the screen. Scores are given, as the hamster eats sunflower seeds. When all the seeds are eaten, the player will move on to the next stage. What the player needs to do is to keep the hamster bouncing using a paddle, controlled by left hand gesture. Beneficial and detrimental items can be grabbed and swiped away by right hand gesture. Since Bounce requires both left and right hand gesture, the player must coordinate eyes with left and right hand movements. We thus hope Bounce can entertain players as well as help train multitasking skills.

Most people may be familiar with using mouse and keyboard to control their computers. Nowadays, motion sensor technology such as Kinect or Leap Motion Controller devices are becoming more popular because the technology give users a new experience of using computers. The technology can detect parts of human body movement and use it as an input to control computers. Kinect is a more comprehensive motion sensor device and can detect whole body movement. Leap Motion Controller, on the other hand, can detect only hand and finger movement but is much smaller than Kinect and, therefore, more appropriate as an input device for personal computers. While Kinect developed by Microsoft is more widely known by large groups of users, Leap Motion Controller is not as well known. Leap Motion Controller has its own application store called Airspace, but there are still only a small number of applications in there, (223 apps total as of March 20, 2015). With motivation to create one more application for Leap Motion Controller users, we have developed an application called Bounce, which is a game similar to the arcade Breakout game with a fun twist. Bounce is controlled by having the Leap Motion Controller sensing gestures from both left and right hands. The left hand moving horizontally controls a paddle which will bounce a ball looking like a hamster to hit bricks represented by sunflower seeds while the right hand makes grabbing and swiping/waving gestures to pick up beneficial items or remove detrimental items in the game. We hope that our Bounce game can benefit players by not only entertaining but also help multitasking training the players





Intersections of Box Complexes of Graphs

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A graph consists of a set of vertices and a set of edges. In this research assume that every graph has no loops and multiple edges. Suppose A and B are disjoint subsets of set of vertices of a graph. We denote the set of all vertices of G which are adjacent to all elements in A by $CN_G(A)$, called the set of all common neighbors of A . We denote by $G[A, B]$ the graph whose vertex set is $A \cup B$ and edge set consists of all edge whose ends belong to different sets; and if all elements in A are adjacent to all elements in B , we call $G[A, B]$ complete. The chromatic number of a graph is the minimum number of colors for which vertices of the graph can be colored such that two vertices which are adjacent are not the same color. But some graph is not easy to compute the chromatic number such as the Kneser graph, J. Matousek and M. Ziegler defined asimplicial complex called the box complex for help to compute the chromatic number.

An abstract simplicial complex consists of a set V and family K of subsets of V such that if σ is an element of K and τ is subset of σ then τ is also an element of K . An element in K is called a simplex.

The box complex of a graph G is a simplicial complex on the set $V(G) \cup V(G)$ with the set of simplices

$$B(G) = \{A_1 \sqcup A_2 \mid A_1, A_2 \subseteq V(G), A_1 \cap A_2 = \emptyset, G[A_1, A_2] \text{ complete}, \\ CN_G(A_1) \neq \emptyset \neq CN_G(A_2)\}$$

when $A_1 \sqcup A_2 = (A_1 \times \{1\}) \cup (A_2 \times \{2\})$; that is, the box complex of graph G consists of the disjoint union of two disjoint subset of set of vertices of G of which all vertices of one set are adjacent to all vertices in another set, and both set must have common neighbors. In this research we interest to study about structures of box complexes of graphs.

Kamibepu found a condition in order to obtain properties that the box complex of the union (intersection) of two graphs is equal to the union(intersection) of the box complex of each graph. That condition can be applied to the case of unions of finite k graph. However, the condition is not enough for the case of intersections of finite k graph, that is,

$$B\left(\bigcap_{i=1}^k G_i\right) = \bigcap_{i=1}^k B(G_i).$$

In this research we develop Kamibepu's condition so that we can obtain the result for intersections of finite k graphs.





A Product Formula for Fixed Point Index and Nielsen Number

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Let X be a compact subset of \mathbb{R}^m and $f : X \rightarrow X$ be a smooth map. We define a Nielsen number of f , denoted by $N(f)$. This number tells us the minimal number of fixed points of maps those are homotopic to f .

In this work, we generalize the idea of the classical Nielsen fixed point theory to study the product formula of the fixed point index and Nielsen number for a fiber map. Such a formula allows us to calculate the fixed point index and Nielsen number of the fiber maps easily.





Optimization Technique for Symmetry Inverse Eigenvalue Problem

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In this work, we apply the optimization technique based on quasi Newton method to find numerically the set of parameters in the specified matrix. The eigenvalues are given priori, then we find the parameters corresponding to the eigenvalues. The matrix is assumed to be symmetric, so the corresponding eigenvalues are real. The developed algorithm is composed of two stages: the numerical values of eigenvalues, and the optimization of fitted eigenvalues. The first step is performed by numerical method such as the QR algorithm, the power method, Jacobi eigenvalue algorithm, Divide-and-conquer etc. while the second step is done by the quasi Newton method. The computer code is implemented in Python language by calling some commands in linear algebra library. So, it is free, and easy to apply for any science and engineering proposes.

From both stages we will apply to approximate parameter in the matrix that corresponds with the eigenvalues by definition the function.

Let $A_{n \times n}$ is a symmetry matrix. x_1, x_2, \dots, x_m is parameter in $A_{n \times n}$ and $\lambda_1, \lambda_2, \dots, \lambda_n$ is real eigenvalues of A ($\lambda_1 \leq \lambda_2 \leq \dots \leq \lambda_n$). Define

$$F(\lambda_1, \lambda_2, \dots, \lambda_n) = (\lambda_1 - \lambda'_1)^2 + (\lambda_2 - \lambda'_2)^2 + \dots + (\lambda_n - \lambda'_n)^2 \quad (1)$$

and $f(A_{n \times n}) = f(x_1, x_2, \dots, x_m) = \lambda_1, \lambda_2, \dots, \lambda_n ; \lambda_1 \leq \lambda_2 \leq \dots \leq \lambda_n$
 f is approximation Eigenvalue of the matrix $A_{n \times n}$ by numerical method in Python.

We will optimize equation (1) by quasi Newton method. We will guess initial $x_1^{(0)}, x_2^{(0)}, \dots, x_m^{(0)}$.

The result of solution is not guarantee converges unless the function is built in quasi Newton method has a quadratic Taylor expansion near an optimum point and the Hessian matrix in quasi Newton method must be positive definite if it is not the iterations are converge to a saddle point and not a minimum.





An Extension of Nicole Brillouët-Belluot’s Problem

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During the Forty-ninth International Symposium on Functional Equations held in Mariatroast-Graz, Austria, 2011. Nicole Brillouët-Belluot determined all continuous bijections $f : I \rightarrow I$ satisfying

$$f(x)f^{-1}(x) = x^2 \quad \text{for every } x \in I, \quad (1)$$

where I is an arbitrary subinterval of the real line.

Moreover, she asked if there is a continuous bijection of I , satisfying (1), which is different from those listed in the following Remark:

Remark.

If $I = \mathbb{R}$, then for any $a, b \in (0, +\infty)$ the function $f : I \rightarrow I$ given by

$$f(x) = \begin{cases} ax, & ;x \leq 0 \\ bx, & ;x > 0 \end{cases}$$

is an increasing bijection satisfying the equation (1).

If $I = \mathbb{R}$, then for every $c \in (-\infty, 0)$ the function $f : I \rightarrow I$ given by

$$f(x) = cx$$

is a decreasing bijection satisfying the equation (1).

If $I = (-\infty, 0]$ or $I = [0, +\infty)$, then for every $c \in (0, +\infty)$ the function $f : I \rightarrow I$ given by

$$f(x) = cx$$

is an increasing bijection satisfying the equation (1).

Next, in 2012, Janusz Morawiec considered all continuous bijections $f : I \rightarrow I$ satisfying the same equation where $I \subseteq [0, +\infty), I \subseteq (-\infty, 0]$ and $0 \in \text{Int}(I)$.

The objective of this research is to determine an extension of Nicole Brillouët-Belluot’s problem by replacing the power of the right-hand side monomial, from 2 to k where k is a natural number.

In other words, we investigate all continuous bijections $f : I \rightarrow I$ satisfying

$$f(x)f^{-1}(x) = x^k \quad \text{for every } x \in I,$$

where $I \subseteq [0, +\infty)$.

With $I_0 = I \setminus \{0\}$, in this research we obtain some results:

$$f^k(x) = \frac{[f(x)]^{a_k}}{x^{a_{k-1}}} \quad \text{for every } x \in I_0, \quad (2.1)$$

$$f^{-k}(x) = \frac{x^{ka_k - a_{k-1}}}{[f(x)]^{a_k}} \quad \text{for every } x \in I_0, \quad (2.2)$$

where $a_k = ka_{k-1} - a_{k-2}$ and $a_0 = 0, a_1 = 1, a_2 = k$.





$(m, n)^0$ - STRONGLY REGULARITY

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In this paper, we introduce the definition of $(m, n)^0$ -strongly regularity in Γ -semigroups. We investigate and characterize the n^0 -strongly regular class of Γ -semigroups using Green's equivalence relations. Moreover, we also obtain the relation among n^0 -semiprime, left- n^0 -strongly regular, right- n^0 -strongly regular and n^0 -strongly regular.





Plastic Antibody for Influenza A virus detection

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This research aims to fabricate the molecular imprinted polymer (MIPs) of H1N3 Influenza A virus by using molecular imprinting technique and suspension polymerization. The developed process of synthesis increases surface area of MIPs which shown as particles. H1N3 Influenza A virus was used as a template molecule for polymer imprinting and to be characterized with scanning electron microscopy (SEM) and confocal microscopy. The SEM images of MIPs showed a clumping of particles and it appeared a porous on MIPs surfaces. Moreover, the confocal microscopy images of MIPs were illustrated red color of H1N3 virus after rebinding to MIPs due to fluorescence dye. This MIPs can use as a plastic antibody for diagnosis other Influenza viruses.

Keywords: Molecular imprinted polymer (MIPs), Scanning electron microscopy (SEM), Plastic antibody





Synthesis of Novel 4-thiazolidinone-PBN Based Nitrones for Screening of Antibacterial

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PBN (α -phenyl-*tert*-butylnitron) is a common nitron spin trapping agent-used for detecting reactive free radical species, which are responsible for many diseases such as neurodegenerative diseases and inflammatory process. Interestingly, PBN has been reported to show potent biological activities as well. Moreover, 4-thiazolidinone, a heterocyclic scaffold found in many natural products, has shown various biological activities such as anticancer, antioxidant, and antimicrobial. These attracted our attention to synthesize a novel 4-thiazolidinone-PBN based nitron. The synthesis starts from the preparation of 4-thiazolidinones **4**, which have been assembled by DCC mediated three-component reaction of amine, aldehyde and mercaptoacetic acid. Aldehyde **5** will be prepared from the reduction of 4-thiazolidinone **4** with DIBALH. Nitron **6** compound will be prepared from the condensation reaction between aldehyde **5** and *N-tert*-butyl hydroxylamine. The obtained final compound will be submitted for antibacterial screening.

Keywords: Nitrones, PBN, Thiazolidinones, DCC, *N-tert*-butyl hydroxylamine





Synthesis of the linker for Cholesterol receptor

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This work focuses on the synthesis of the linker; an isophthalamide unit; a part of cholesterol receptor. The receptor was designed with 3 units of the linker. These units play an important role in the structure of the receptor as water-solubilising groups because each unit contains 12 ester groups which will be finally hydrolysed to 12 carboxylated groups in the last step of the synthesis of the receptor. The linker was successfully synthesized in 3 steps with approximately 62% overall yield.

Keywords: supramolecular chemistry, cholesterol, receptor





Binding investigation of Dengue Virus NS3 Protease inhibitors using molecular modeling

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Dengue virus (DENV) is the cause of dengue fever. Currently, the treatment of dengue fever is symptomatic because there are no available drugs and vaccine. NS3 protease (NS3pro) is an essential enzyme in the DENV. NS3pro consists of six β -strands arranged into two β -barrels and the catalytic triad residues are His51, Asp75 and Ser135. In the active form of NS3pro, an essential cofactor of NS2B is found in the complex with NS3pro. Three compounds of 8-hydroxyquinoline derivatives are found as potent NS3 protease inhibitors. Therefore, the objective of this work is to study the binding between DENV NS3pro and effective inhibitors using molecular modeling. For starting conformation, the crystal structure of NS3pro/NS2B complexed with naphthoyl-KKR-H (PDB code: 3U1I) was taken from Protein Data Bank. Structures of inhibitors were optimized at M062X/6-31G(d) in Gaussian09 program. Binding of the inhibitors in NS3pro/NS2B were investigated using GOLD molecular docking program. The molecular dynamics simulations for 50 ns were then performed by using GROMACs program.

From the results, root-mean-square deviation (RMSD) of backbone atom in MD trajectories is investigated in order to evaluate the structural stability. No significant change in the structure after the 10 ns MD trajectories is found with the RMSD value of 2 Å. The 50 ns MD simulations of the complex between DENV NS3pro/NS2B and the derivatives of 8-hydroxyquinoline reveals the stabilized complex structure and key amino acids for the binding are also investigated. The results can be helpful to explain the binding mode of the inhibitors and can be used as a guideline for designing the new DENV NS3pro inhibitors.





Cosmetic Active-Ingredients Encapsulation by beta-Cyclodextrin Polymer Cross-linked by Citric Acid

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Beta-cyclodextrin polymer (pbCD), using in cosmetic active-ingredients encapsulation e.g. curcumin, 4-*t*-butyl-4'-methoxydibenzoylmethane (DBM) and ethylhexyl-*p*-methoxycinnamate (EHMC), is prepared by the reaction between beta-cyclodextrin (bCD) and citric acid in the present of NaH₂PO₄ as catalyst at 140°C for 30 minutes. The properties and characterizations of pbCD with and without the cosmetic active-ingredients are studied by ¹H-NMR, gel permeation chromatography (GPC), infrared spectroscopy (IR), and scanning electron microscope (SEM). The absorption of curcumin, DBM and EHMC can detected in water and found λ_{\max} at 426, 363 and 312 nm, respectively. The percentage of photostability of the pbCD with curcumin, DBM and EHMC in water are by 45.40%, 95.70% and 70.43% respectively after explosion to UVA and UVB for 60 minutes. These results are promising to use pbCD as drug carrier for active compounds which are not soluble in water.

Keywords: Beta-cyclodextrin polymer, Curcumin, 4-*t*-butyl-4'-ethoxydibenzoylmethane, Ethylhexyl-*p*-methoxycinnamate





Trace elements and Heavy Metals Analysis in Herbal Cosmetics by AAS

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In this study trace (micronutrients) metals including Cu, Fe and Mn were determined using flame atomic absorption spectrometry (FAAS). While heavy metal, Hg, was determined by hydride generation technique (cold vapour atomic absorption spectroscopy) using Flow Injection Atomic Spectroscopy (FIAS). Quantitative estimation of the trace metals and the heavy metal was performed in four herbal cosmetics sold in superstores; toner, liquid soap, conditioner and lotion. The experimental results reveal that Cu, Fe, Mn and Hg were found below the permissible limits of standardization of herbal cosmetics. This study demonstrates that quality of the herbal cosmetics sold in Thai superstores is safe for human use. However, stringent regulations for the herbal cosmetics are required to ensure product safety and quality before launching them on the market. In conclusion the study provides a simple and convenient AAS method which can be effectively adopted at industrial level for the quality control and standardization of herbal cosmetics and other related products.

Keywords: Herbal cosmetics, trace elements, heavy metals, AAS





Colorimetric and Fluorescent Sensing of Chromium in Industrial Metal Coating by Salicyladimine Based Receptor

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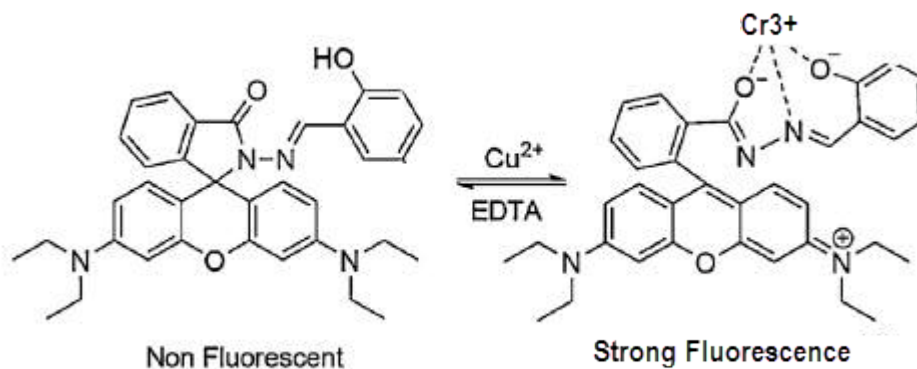
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A new fluorescent molecule based on salicyladimine-rhodamine B (SARB) has been synthesized and its photochemical properties were systematically studied. Compounds have been characterized by means of FT-IR Spectroscopy, $^1\text{H-NMR}$ spectroscopy. The non-fluorescent salicyladimine-based can selectively detect Cr^{3+} cation over some other metal ions in ethanol solutions with a 1:1 stoichiometry, leading to prominent fluorescence OFF-ON switching. The obtained SARB- Cr^{3+} complex can subsequently serve as a sensitive and selective chemosensor for EDTA. Complete signal quenching (fluorescence ON-OFF switching) can also be observed, ascribing to the extraction of Cr^{3+} cation and the resulting deformation of SARB- Cr^{3+} complex.

Keywords: Salicyladimine-based, Rhodamine B, Colorimetric fluorescent sensor





Calix[4]pyrroles and their binding properties

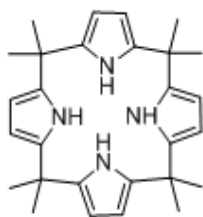
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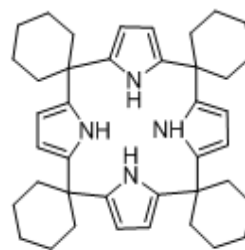
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This research is subjected to synthesize and study the binding properties of Calix[4]pyrroles. Both cpds were successfully prepared from the reactions between pyrroles and ketones; i.e. acetone and cyclohexanone. Their anion recognition will be investigated by using ^1H NMR titration with tetrabutylammonium chloride (nBu_4NCl) and Tetrabutylammonium bromide (nBu_4NBr)



Calix[4]pyrrole



meso-Tetracyclohexylcalix[4]pyrrole

Keywords: Calix[4]pyrrole, ^1H NMR titration, Anion recognition.





Molecular Imprinted Polymer of bovine serum albumin (BSA)

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This research aims to develop the imprinted polymer synthesis for Bovine serum albumin (BSA) protein by core-silica shell nanoparticles based on Molecular Imprinting Polymer (MIP). The characteristic for the size of the particles are measured and compared with silicon nanoparticles by using zetasizer and Scanning Electron Microscope (SEM). Quartz Crystal Microbalance (QCM) is method to confirm effective fabrication of imprinted polymer on silicon. All of these results can be compared with polymer without protein template or Non-imprinted Polymer (NIP). Furthermore, this work can be applied to improve isolation of BSA in order to preliminary study for Human Serum Albumin (HSA).

Keywords: Bovine serum albumin (BSA) protein, Molecular Imprinting Polymer (MIP), Scanning Electron Microscope (SEM), Quartz Crystal Microbalance (QCM)





Synthesis of Nickel Imbedded in Polyaniline - Derived N- and O-Doped Mesoporous Carbons electrocatalyst as an Efficient Counter Electrode for Dye-Sensitized Solar Cell (DSC)

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In this research, the aim is to design a superior electrocatalyst by combining high electrical conductivity and electrocatalytic activity into one material: nickel imbedded in polyaniline-derived N- and O- doped mesoporous carbon (Ni-PDMC), in which Ni serves as a catalyst and PDMC serves as an electrical conductor. The synthesized Ni-PDMC is introduced to the dye-sensitized solar cell (DSC) system as a counter electrode (CE) electrocatalyst to replace the expensive platinum (Pt) CE.

The Ni-PDMC was synthesized by polymerizing polyaniline (PANI) in sites within the pores of SBA-15 mesoporous silica, followed by immobilizing Ni(II) into the PANI/SBA-15 before pyrolysis of Ni-PANI/SBA-15 under an inert atmosphere. Finally, the silica framework was etched away.

The microstructure of the Ni-PDMC electrocatalyst was first examined by Scanning Electron Microscopy (SEM). Interconnected rod-like structure and a well-defined linear array of mesoporous structure were observed. These observations well reflected the geometric characteristics of the SBA-15 template and indicated successful introduction of the porous feature for this electrocatalyst. The energy-dispersive X-ray spectroscopy (EDS) analysis the presence of Ni suggesting that the Ni atoms are imbedded in the carbon framework of the PDMC. The diffraction peaks of the Ni-PDMC can be considered as a result of the combination of Ni, Ni(OH)₂, NiOOH. Therefore, this result also confirms that Ni imbedded in mesoporous carbon has been successfully synthesized. Atomic Absorption Spectroscopy (AAS) analysis disclosed the existence of Ni with the concentration of 7.35 mmol/g (43.17Wt %)





Study the effect of graphene content on mechanical and biological properties of hydroxyapatite filled polylactic acid for bone replacement

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Hydroxyapatite (HAp) was produced from crocodile bones by thermal process at 900°C using a heating rate of 3°C/min with 4 h holding time. X-ray diffractometer (XRD), Fourier transform infrared spectrometer (FTIR), and scanning electron microscope (SEM) were used to characterize the obtained HAp. Polylactic acid (PLA)/HAp/GR composites were prepared as a film by solution casting. The ratio of PLA: HAp/GR is 95:5 and the ratios between HAp and GR are 100:0, 75:25, 50:50, 25:75 and 0:100 (weight ratio), respectively. The effect of the amount of GR on the mechanical properties including tensile strength, tensile modulus, and elongation at break of PLA/HAp/GR composites films were studied. It was found that tensile strength, tensile modulus, and elongation at break of the composites decreased with an increase of GR content. In addition, scanning electron microscope (SEM) was used to show distribution of HAp and GR on PLA film. The degradation behavior of PLA/HAp/GR composites in the SBF buffer solution and *enzymes proteinase K* was also investigated. It was observed that PLA/HAp/GR composite decomposed all ratios. Furthermore, the toxicity of graphene was analyzed by Cell-cytotoxicity testing (MTT assay) with the human lung fibroblast MRC-5.





Biodiesel production using calcium oxide with efficiency as catalyst

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In the present study, commercial quick lime was calcined to produce calcined calcium oxide (CCO). CCO was further upgraded the efficiency by calcination-hydration-dehydration treatment to yield calcium oxide with high activity (COH). The performance of both CCO and COH catalysts were examined by X-Ray diffraction (XRD) and Scanning Electron Microscopy (SEM). The catalytic activity via transesterification with refined palm oil of both catalysts were studied on the percentage of fatty acid methyl ester (FAME) conversion which determined by ¹H-NMR. The results revealed that the highest FAME conversion for CCO was 97.93% at 8% wt of catalyst amount, 14:1 of methanol to oil molar ratio and 2 h of reaction time while for COH, the highest FAME conversion was 98.45% at 5% wt of catalyst amount, 12:1 of methanol to oil molar ratio and 1 h 30 min of reaction time. The comparative results confirmed that COH had higher efficiency than CCO for using as catalyst in biodiesel production.

Keywords: Biodiesel, Calcium oxide, Catalyst, Fatty acid methyl ester





Synthesis of Three-Dimensionally Ordered Macroporous Mn-Substituted Hydroxyapatite (3DOM-MnHAp) by Sol - Gel Method

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Hydroxyapatite (HAp, $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$) has been extensively studied due to its elemental compositions are similar to bones and teeth making HAp a desirable biocompatible material for medical applications. In this study, physical and chemical properties of HAp were modified by incorporating Mn^{2+} ions into the HAp structure using a sol-gel method in order to enhance cell adhesion. Furthermore, by employing PMMA colloidal crystal arrays with sol-gel method, the novel three-dimensionally ordered macroporous 7% Mn-substituted HAp (3DOM-MnHAp) was successfully fabricated. The effect of aging time on the HAp phase compositions was investigated by Power X-ray diffraction spectrometer. The result indicated that the maxima of 86.4% HAp was achieved after the aging time of 8 hours with minor components of $\text{Ca}_3(\text{PO}_4)_2$, CaCO_3 and CaO . Moreover, the Mn^{2+} concentration was varied in the range of 10%, 15%, and 20%. Furthermore, magnetic property of the synthesized 3DOM-MnHAp biomaterial was investigated.





Cu-Promoted Fe_xO_y Catalysts from Fe-Coagulated Sludge Produced by Ferric Chloride Coagulation of Wastewater

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The objective of this work is to study an iron oxide (Fe_xO_y) catalyst by coagulation of wastewater and investigate the effect of copper promotion on the iron oxide (Fe_xO_y) catalyst. Copper promoted iron oxide ($z\text{Cu-Fe}_x\text{O}_y$) catalysts were prepared by coagulation of wastewater and coagulant at the volume ratio of 1:2, impregnation by $z = 0.5, 1.0, 1.5, 2.0, 5.0,$ and 15.0 wt.% Cu, and calcination at 750°C for 4 h. All $z\text{Cu-Fe}_x\text{O}_y$ catalysts were investigated by X-ray diffraction (XRD) and X-ray absorption (XAS), including X-ray Absorption Near-Edge Structure (XANES) and Extended X-ray Absorption Fine Structure (EXAFS). These promoted catalysts were compared to the unpromoted ones in terms of oxidation state, phase, and local structure prior to their uses for hydrogen production by water splitting process in the further study.

The present study focused on the preparation of iron oxide by the coagulation of wastewater using ferric chloride as a coagulant and the Cu-promoted iron oxides. The characterization by X-ray diffraction (XRD) and X-ray Absorption Spectroscopy (XAS), including X-ray Absorption Near-Edge Structure (XANES) and Extended X-ray Absorption Fine Structure (EXAFS), showed the effect of Cu addition on the structure of iron oxide catalysts. As increasing wt. % of Cu, the oxidation number of iron tended to increase. The $z\text{Cu-Fe}_x\text{O}_y$ catalysts showed the main phase of wüstite (FeO) at $z = 0.5, 1.0, 1.5,$ and 2.0 and the main phase of magnetite (Fe_3O_4) at $z = 5.0$ and 15.0 .





Synthesis of (3R, 4S)-5-ethyl-1,2,3,4-tetrahydropyridin-3,4-diol part of anticancer agent, (+)-Tabersonine

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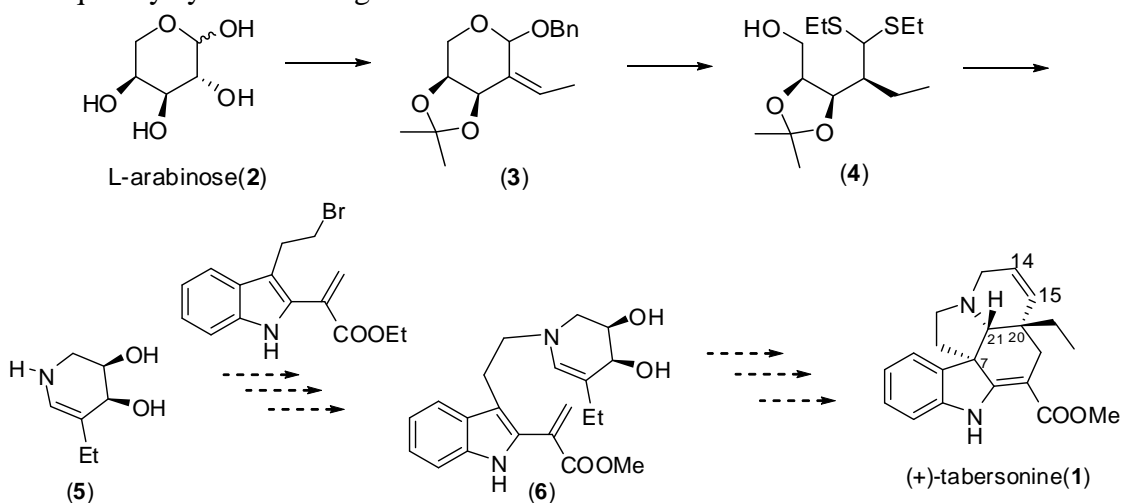
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Tabersonine (**1**) isolated from *Amsonia tabernaemontana*, plays a central role in the biosynthesis of *Aspidosperma* alkaloids, serving as the biogenetic (as well as synthetic) predecessor of other members of the *Aspidosperma* family—most notably of vindoline, a key component of the clinically important antitumor agents vinblastine and vincristine. (3R, 4S)-5-Ethyl-1,2,3,4-tetrahydropyridin-3,4-diol (**4**) is a synthetic fragment require for (+)-tabersonine in our synthetic route. It should be note that the chiral centers of the diol in **6** are responsible for controlling the entire stereochemistry of the aspidosperma-type skeleton in **1**. Therefore, our task was to establish an efficient synthetic route to the amine part **5**. The hydroxylated piperidine (**5**) was prepared from L-arabinose. The key steps were benzylation, acetonide protection of 1,2-diol of L-arabinose. Oxidation of remaining alcohol, Wittig reaction and hydrogenation of compound (**3**) followed by formation of dithioacetal gave compound **4**. The final steps were replacement of hydroxyl group with amine and removal of dithioacetal, subsequently cyclization to give amine **5**.



Keywords: Aspidosperma alkaloids, Tabersonine, L-Arabinose





Fabrication of Silicon Nanoparticles by Electrochemical Etching Method: Application of Single Tank Anodization Cell

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Currently, research on silicon nanoparticles have been highly interesting in science because the unique properties of silicon nanoparticles which can be developed for many applications such as drug delivery, bombarding cancer, battery, sensor and etc. Silicon nanoparticles can be synthesized using a variety of techniques but in this work, porous silicon layers were fabricated by using the electrochemical etching technique owing to low cost, simplicity of fabrication, and large quantity of nanoparticles obtained. The essential conditions for the formation of porous silicon are low current density and high concentration of electrolyte solution. We attempted to vary these conditions in order to obtain porous silicon layers. The single tank reactor was used because small amounts of the electrolyte solution (HF:EtOH) were required. Note that, hydrofluoric acid is extremely dangerous. The recycled silicon wafers were employed to form the porous silicon during this work. The morphology of the layers was also observed by Scanning Electron Microscopy (SEM) and the size of the silicon nanoparticles can be analyzed by Fluorescence spectroscopy.





The study of optical properties of 3,5-dihydroxytoluene and binaphthol derivatives as sensor for metal ion detection

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2,2'-(5-methyl-1,3-phenylene)bis(oxy)bis(*N*-(4-nitrophenyl)acetamide) (**L**₁) and 2,2'-((1,1'-binaphthalene)-2,2'-diylbis(oxy))bis(*N*-(4-nitrophenyl)acetamide) (**L**₂) were synthesized and characterized ¹H-NMR, ¹³C-NMR, ESI-MS and Elemental analysis. The sensitivity and selectivity properties of **L**₁ and **L**₂ towards various metal ion such as Co²⁺, Ni²⁺, Cu²⁺, Zn²⁺, Hg²⁺, Pb²⁺ and Fe³⁺ in DMSO solution were investigated by ¹H-NMR, UV-vis and Fluorescence spectroscopy. For UV-vis titration, the maximum absorption wavelength of **L**₁ at 326 nm and **L**₂ at 329 nm gradually decreased when addition of metal ions. For fluorescence titration, the intensity emission of **L**₂ at 380 nm would be enhanced as the concentration of metal ions (Co²⁺, Ni²⁺, Cu²⁺, Zn²⁺, Hg²⁺, Pb²⁺ and Fe³⁺) increased. With increasing the concentration of Cu²⁺ ion, the emission band of **L**₂ was quenched, indicating the complexation of **L**₂ and Cu²⁺ ion. For ¹H NMR, the spectrum of **L**₁ and **L**₂ with various metal ions showed that the proton regions of **L**₁ and **L**₂ were slightly changed and broaden because of disturbing the paramagnetic properties of metal ions. The ratio of complexation between **L**₁ and **L**₂ with metal ions was 1:1 form by Job's analysis. These results exhibit the **L**₂ is highly selective to Cu²⁺ ion over other metal ions.





Synthesis of Thymyl Esters for Study Their Insecticide Activity Against *Plutella xylostella*

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Thymol is one of essential oil from plant metabolism. This compound was firstly evaluated against *Plutella xylostella* to determine their acute toxicity by our group research. It was found that thymol was highly toxic to third instars of *P. xylostella*. with a LD₅₀ of 0.22 µg/larva. We have now extended our studies on the thymol derivatives to assess its utility in the control of *P. xylostella*. Five thymyl esters were selected to synthesize by using our developed protocol. The reaction between thymol and acid bromides, generated *in situ* from carboxylic acids and the combination of triphenylphosphine and tribromomethyl phenyl sulfone, proceeded smoothly in the presence of triethylamine to furnish the corresponding thymyl esters in moderate to high yields. The insecticidal activity of these compounds against *Plutella xylostella* is in progress.

Keywords: Thymyl ester, Thymol, *Plutella xylostella*, Insecticidal activity.





Chemical composition of *Piper ramipilum*

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Piper ramipilum is a plant which is mostly found in the south of Thailand. The stems and leaves of *Piper ramipilum* were extracted by methanol. The crude product from methanol extract was partitioned by column chromatography, using hexane, dichloromethane, ethylacetate, and methanol as eluent to give four partitions. From MTT assay study, the ethyl acetate fraction showed strong cytotoxicity activity and has been separating for the active compound.

Keywords: *Piper ramipilum*, MTT





Development of Economical Counter Electrode Electrocatalyst for Dye-Sensitized Solar Cell by Employing N- and O-Doped Mesoporous Carbon Derived by Polyaniline with surface modification of Cobalt particles

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Owing to low mass density, continuous porosities, great mesopore volume, high electrical conductivity, and excellent electrocatalytic activity, cobalt immobilized on N- and O- doped mesoporous carbon (Co-MC) can be a favorable electrocatalyst candidate for counter electrode (CE) of dye-sensitized solar cell (DSC). In this study, the morphology and surface structure of Co-MC were evaluated in order to gauge its potential use as a CE in DSC.

To synthesize Co-MC, polymerization of aniline within the pores of SBA-15 mesoporous silica was carried out which produced PANI/SBA-15. The immobilization of Co into the PANI/SBA-15 was easily achieved by stirring PANI/SBA-15 with aqueous $\text{Co}(\text{NO}_3)_2$ solution. Finally, upon carbonization of the resulting Co-doped PANI/SBA-15 material, followed by etching away the SBA-15 hard template, Co-MC was obtained.

The structure and morphology of the synthesized Co-MC were characterized by scanning electron microscopy (SEM) measurement. The SEM image of Co-MC reveals the formation of nearly rod-like carbon microstructures with average length of about 0.35 μm . The result of energy dispersive X-ray spectroscopy (EDX) confirms that MC-supported Co particles was formed successfully via in situ polymerization of aniline within the mesoporous of silica support. Powder X-ray diffraction (PXRD) pattern of the obtained Co-MC reveals the formation of Co particles consisting of Co_3O_4 . This can confirm the presence of Co on MC which is in agreement with EDX result.

Keywords: Dye-Sensitized Solar Cell (DSC), N- and O-Doped Mesoporous Carbon, Counter Electrode, Polyaniline, Cobalt particles





Synthesis and Structural Studied of Fluorescence Metal Organic Framework for anions film sensor

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Mn-MOF has been synthesized from the reaction of $\text{Mn}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$, 5-aminoterephthalic acid and 4,4'-bipyridine by hydrothermal method. The compound has been characterized by IR, TGA, elemental analysis and XRD technique to confirm its structure. XRD and TGA results exhibited that after desolvate its structure still remained. The solid state fluorescence of compound under λ_{ex} 420 nm exhibited emission at 573 nm assigned to Ligand to Metal charge transfer (LMCT). The fluorescence was quenched upon desolvation possibly due to structural distortion. The studied of anion sensing by preparing thin film of desolvated compound was determined by fluorescence spectroscopy. The desolvated compound in different solution of anions (F^- , Cl^- , Br^- , NO_3^-) exhibited fluorescence sensing, especially for F^- anion. The fluorescence intensity gradually increased when increasing the concentration of F^- . The fluorescence was quenched by vibration of water molecular therefore bonding between water and anions can reduce fluorescence quenching. Stronger hydrogen bonding between water and F^- has led to its fluorescence enhancement. Energy dispersive spectroscopy (EDS) confirmed that F^- has been incorporated into the framework of compound.

Keywords: Metal Organic Framework; Anions film sensor





Isolation and structure elucidation of biologically active compounds from *Streptomyces* sp. strain 22-4

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At present, there are many studies that focus on discovery of novel biologically active compounds isolated from several natural resources. This also includes micro-organisms especially *Streptomyces*. This genus of gram-positive bacteria is one of the major sources for antibiotic and other biological activities. Therefore, the search for new *Streptomyces* species producing bioactive compounds has attracted the interest from many research groups. Recently, a new species *Streptomyces* sp. strain 22-4 was isolated from asparagus and its culture broth was first purified using several chromatographic techniques to obtain cyclic dipeptides, cyclo(L-Pro-L-Tyr) and cyclo(D-Pro-L-Tyr). Here, we report the isolation and structure elucidation of other compounds produced by *Streptomyces* sp. strain 22-4. These compounds will be further analyzed for their biological activities.





Cosmetic Active-Ingredients Encapsulation by gamma-Cyclodextrin Polymer Cross-linked by Epichlorohydrin

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Gamma - cyclodextrin can be synthesized by reaction between gamma-cyclodextrin and epichlorohydrin in 33% NaOH at room temperature for 2.5 hours. The objective of this project is increase the water solubility of cosmetic active ingredients e.g. curcumin, 2-ethylhexyl-*p*-methoxycinnamate (EHMC) and 4-*tert*-butyl-4'-methoxydibenzoylmethane (DBM) by γ -cyclodextrin polymer crosslinked with epichlorohydrin (pyCD). The pyCD can be characterized by $^1\text{H-NMR}$, IR. The molecular weight of pyCD is studied by gel permeation chromatography (GPC). The absorption of curcumin, EHMC and DBM in water is investigated by UV-VIS spectrophotometry and found the λ_{max} at 425 nm, 312 nm and 358 nm, respectively. The percent photostability of these active ingredients is also studied in water show that EHMC and curcumin are 87.03% and 77.82% respectively, whereas the photostability of DBM decreased to 37.62% after expose to UVA and UVB for 60 min. These results can be developed to be use the pyCD as drug carrier for hydrophobic compounds.

Keywords: γ -cyclodextrin, polymer, epichlorohydrin, dibenzoylmethane





Microwave – assisted synthesis of Rh/CeO₂ nanoparticle for using as catalyst in the biomass reforming reaction

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Rhodium doped cerium (IV) oxide catalysts with various amounts of rhodium 1, 3, 5, 7 and 10 mole percent were prepared by microwave-assisted wetness impregnation on the cerium (IV) oxide support. In the process, rhodium (III) chloride hydrate was a rhodium source and the ceria powder used was synthesized by decomposition of the cerium (III) chloride-triethanolamine complex at 600 °C for 2 h in an ambient atmosphere. All the rhodium doped catalysts were characterized by FT-IR, SEM and XRD. Biomass tar reforming was carried out for all rhodium doped catalysts along with pure cerium (IV) oxide support. The result showed that the catalytic activities got higher as the amounts of rhodium doped increased.





Design, Synthesis and Biological Evaluation of Novel HIV1-RT Inhibitors

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A novel series of benzoxazole based inhibitors were designed synthesized and evaluated for their in vitro HIV1-RT activity. Structure based design was used to develop the novel benzoxazole compounds which have high structural complimentary to the pyrimidine based non-nucleoside reverse transcriptase inhibitor (NNRTI) Rilviripine. Reagent selection was performed to cover diverse chemical space as possible in our attempts to improve both biological potency and physical properties compared to known HIV1-RT drugs. The most suitable synthetic route to the compounds was determined by extensive literature searches. All intermediates and final compounds were confirmed by nuclear magnetic resonance (NMR) and mass spectrometry (MS). The compound was evaluated in term physical properties and its efficiency to inhibit HIV1-RT.

Keywords: Reverse transcriptase inhibitor, NNRTIs, HIV1-RT, benzoxazole, structure based design





Analysis of Trace Metals Quality in Herbal Medicines

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In this work, trace metals like Cu, Mn and Fe were quantitatively estimated using Atomic Absorption Spectrometry (AAS). Also, heavy metals such as Hg were determined by hydride generation technique using Flow Injection Atomic Spectroscopy (FIAS). Heavy metals and trace metals were found appreciably well below the permissible limit of standardization of herbal medicine. This study presents the status of heavy metals and trace elements in Thai marketed herbal medicine formulations and also provides a simple and convenient AAS method which can effectively be adopted at industrial level for the quality control and standardization of Thai herbal medicine preparations and other related products.

Keywords: trace metals, heavy metals, AAS method, herbal medicine





Design, Synthesis and Biological Evaluation of Novel Malaria Inhibitors

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The goal of this project is to apply molecular design techniques, organic synthesis and biochemical methods to develop novel leads as anti-malarial and HIV1-RT inhibitors. Novel pyrimidine scaffolds not previously employed for malaria studies based on literature reports will be developed in this project. The first step in the process is to apply ligand and structure based design considerations to develop novel compounds. Next, synthetic routes and reagent selection will be performed to afford compounds with both good physical properties and the ability to explore diverse conformational and biological property space. The compounds that are synthesized will be submitted for testing using the K1 strain of Plasmodium Falciparum at Biotech and will also be assessed as HIV1-RT inhibitors.

Keywords: Plasmodium Falciparum, anti-malarial inhibitors, HIV1-RT, ligand and structure based design





Preparation of Recombinant Non-Discriminating Aspartyl-tRNA Synthetase from the Human Pathogen *Helicobacter pylori*

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Helicobacter pylori is a gram-negative pathogenic bacterium, which is the main cause of chronic gastritis and gastric ulcers. *H. pylori* genome only codes for 19 aminoacyl-tRNA synthetase, an enzyme crucial for the biosynthesis of aminoacyl-tRNA. This organism relies on indirect aminoacylation pathways in order to generate a full set of aminoacyl-tRNA *in vivo*. We are particularly interested in an enzyme with relaxed tRNA specificity, the non-discriminating aspartyl-tRNA synthetase (ND-AspRS). This enzyme generates both Asp-RNA^{Asp} and Asp-tRNA^{Asn}. The latter one is subsequently converted to the correctly aminoacylated Asn-tRNA^{Asn} via transamidation reaction. Here we report overproduction and purification of *H. pylori* ND-AspRS using *Escherichia coli* (*E. coli*) as a host. The chemical competent cells, *E. coli* BL21(DE3), were prepared and transformed with pPTC002, a plasmid encoding *H. pylori* ND-AspRS. The transformed cells were grown and the overexpression was induced using isopropyl-β-D-1-thiogalactopyranoside (IPTG) for 45 minutes in order to minimize toxicity caused by ND-AspRS to host cells. The cells were then harvested using centrifugation and the protein was purified using Ni-NTA affinity chromatography. The resulting protein was obtained in greater than 95% purity as determined by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE).

Keywords: Aspartyl-tRNA Synthetase, Affinity Chromatography, *Helicobacter pylori*





Searching for a New Botanical Insecticide against *Plutella xylostella* from the leaves of *Wediliatrilobita* (L.)

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The diamondbackmoth (*Plutella xylostella*) is a serious agricultural pest of economic crops in Thailand. In order to against this pest, cultivators have to spend a lot of currency on chemical pesticide causing contaminant in foods and destroying the environment. This objective study, therefore, is to search for a new environmentally-friendly botanical insecticide from native plants. *Wediliatrilobita*(L.) were selected to assess its utility in the control of *P. xylostella*. The dried leaves of *W.trilobite* were extracted with hexane, dichloromethane, ethyl acetate and ethanol, respectively by Soxhlet apparatus. The results showed that ethanol crude extract was obtained in the highest yield (5.02%) following hexane (3.59%), ethyl acetate (1.14%) and dichloromethane (1.02%). All crude extracts were examined for the toxicity against the second instars of *P. xylostella* using topical application method. The dichloromethane extract exhibited hightoxicitywith LD₅₀ = 548 and 422 ppm at 24 and 48 h post-treatment, respectively. Then, dichloromethane extract was fractionated using vacuum silica gel column chromatography and eluted with a gradient of gradually increasing polarity (5-10% increments) of hexane-ethyl acetate, and ethyl acetate-methanol, respectively to obtain five fractions (F1: 100% hexane, F2:100%–hexane:EtOAc(95:5), F3: hexane:EtOAc(90:10)–hexane:EtOAc(60:40), F4:hexane:EtOAc(60:40)–100% EtOAc and F5: EtOAc:MeOH(80:20)–EtOAc:MeOH(80:20)). Fraction F1 was firstly chosen to isolate an active ingredient byusing Preparative TLC. We found that sub-fraction F1-T1 wasthe mixture of ent-kauranediterpenesand sub-fraction F1-T2 was the mixture of fatty acids. The purification of sub-fraction F1-T1and their toxicity against *P. xylostella* is in progress.

Keywords: Botanical Insecticide, *Plutellaxylostella*, *Wediliatrilobita*





Identification of Jasmine Rice by Electronic Nose

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Thai jasmine rice is recognized to be the best quality rice due to its unique fragrance, good texture, long-grain rice, soft and sticky after cooking. However, traders began to impure the jasmine rice by mixing other rice having lower qualities and prices. Therefore, identification of real Thai jasmine rice based on fast and nondestructive measurement is very important at current state. In this work, we demonstrate an application of an electronic nose (E-Nose) based on eight metal oxide gas sensors; TGS 821, TGS 822, TGS 825, TGS 826, TGS2600, TGS2602, TGS2610, TGS2620 for identification of jasmine rice. Principal component analysis (PCA) was used as a pattern recognition and classification of data. Adulteration of jasmine rice was simulated by mixing of white rice and patum rice. The ratio of jasmine rice: other rice samples was varied as 1:1, 2:1, 5:1 and 9:1 by weight, respectively. 30 grams of pure and mixture rice samples were analyzed by the E-nose with the sampling time of 2min. The experimental results show that TGS 822 and TGS 826 gas sensors exhibit the highest response to the mixture of jasmine rice/patum rice and jasmine rice/white rice, respectively. PCA results clearly show the classification between the pure jasmine rice and adulteration with patum rice and white rice. The detection limits of classification of jasmine rice/patum rice and jasmine rice/white are 1:1 and 9:1 by weight, respectively.





Application of Webcam as a Motion Tracker in Basic Physics Laboratory

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We have developed a system that can automatically give a score to a student laboratory report. Even the system can be used in general, we aim our work mainly to the experiment Hy-2 measuring the viscosity of a liquid. We take the advantage of the existing Google doc by designing a cloud document for the students to submit their reports. This can be very convenient since the students can submit their works via any platforms of their smart devices. The reports are kept in the form of spreadsheet, which can be analysed by the macro language like VBA or Openoffice.org BASIC. The score is given base on the discrepancy of the results reported by the students and the values from the sensors. We use the single board Raspberry Pi as our workstation to analyse the reports by comparing with the experimental values. As a prototype, we connect our Pi with the camera module to create a motion tracker, which we use to track the position of the metal ball moving in a liquid. By using the free-of-charge cloud document and the tiny, but powerful, Raspberry Pi workstation, our system is not so pricy and very suitable for the large laboratory classes. We expect that this should help the instructor of the basic laboratory in their tedious but very importance jobs. Our system should also reduce the bias from the different instructors and gives a fair check to the student reports.

Keyword: Raspberry Pi, VBA,Hy-2, Camera Module





Rotation curve of galaxies and pressure from dark matter annihilation

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There are many evidences for the existence of dark matter. From cosmological observations, we found that a quarter of the Universe is composed of dark matter. Dark matter can be interacted by gravitational force and can be weakly interacted by weak force. There is no interaction with electromagnetic and strong force. Although we can measure the amount of dark matter precisely, the property of dark matter is still a big and important problem in cosmology and particle physics. However, we can measure the properties of dark matter by indirect detection which based on the assumption that dark matter and anti-dark matter can annihilate into standard model particles such as electrons, positrons, protons, anti-proton, neutrinos and photons. The signature of dark matter particles can be investigated from the productions of dark matter annihilation.

In this work, we investigate the contribution of dark matter annihilation to the total gas pressure and consider the possibility that it has a significant effect on the rotation curve of low surface brightness (LSB) galaxies. We focus on the energy density associated to electrons and positrons arising from dark matter annihilations, neglecting other processes, such as dark matter decay, or other annihilation products, such as protons and antiprotons. We adopt a model-independent approach, in which all particles are created with the same initial energy. Results for a particular dark matter candidate can be obtained by convolution with the appropriate source function. Since the characteristic energies involved are of the order of the mass of the dark matter particle, and this mass is usually much larger than the rest mass of the electron, electrons and positrons will be relativistic at the moment of their creation. However, they can efficiently lose their energy through different processes, such as Inverse Compton scattering (ICS), synchrotron radiation, Coulomb collisions, bremsstrahlung and ionization. By comparing the predicted rotation curves with observations of dwarf and low surface brightness galaxies, we show that the pressure from dark matter annihilation may affect the rotation curves of LSB galaxies.





Photoacoustic setup for measuring the thermal conductivity of solid sample

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Photoacoustic spectroscopy is a technique with the simple setup for measuring the thermal conductivity of the material. This technique is generally setup on optical table then it is not easy to be moved. The aim of this research is to reduce the setup to be small and portable with low-cost. In the setup, the laser diode, which is connected to the modulation circuit, is use as the power source. The sample cell was designed to be able to embed the laser diode and a microphone. Both devices can be changed. When the modulated laser beam incidents on the surface of the sample, the thermal wave surround the surface of the sample changes the pressure and generate the acoustic wave with detected by the microphone. The lock-in amplifier measures the signal amplitude and phase. The thermal conductivity of the example is calculated. The photoacoustic cell is designed in the cylinder shape with 52.8 mm in height, 50.8 mm in diameter, used for solid sample not exceed $10.5 \times 10.5 \text{ mm}^2$ in size and a thickness up to 5 mm.





LED Analyzer

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Light Emitting Diode (LED) is a semiconductor light source with wide range of applications. Understandings of the spectrum and emission profile of LED are thus important. In this project we develop the technique to measure the emission profile of LED through the image from a half-sphere reflector. To get a wide-angle image, a fish-eye lens is used. The distort image caused from wide angle lens is corrected using suitable transformation. Together with our mathematical model of the system, the emission profile of an LED can extract from the measured image.

Keywords: LED, emission profile, half-sphere, fish-eye lens, distortion





Application of Machine Vision to Scale Reading in Basic Physics Laboratory

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We have developed a system that can automatically give a score to a student laboratory report. Even the system can be used in general, we aim our work mainly to the experiment M-6 measuring Young's modulus of a metal wire. We take the advantage of the existing Google doc by designing a cloud document for the students to submit their reports. This can be very convenient since the students can submit their works via any platforms of their smart devices. The reports are kept in the form of spreadsheet, which can be analysed by the macro language like VBA or Openoffice.org BASIC. The score is given base on the discrepancy of the results reported by the students and the values from the sensors. We use the single board Raspberry Pi as our workstation to analyse the reports by comparing with the experimental values. As a prototype, we connect our Pi with the camera module to create a machine vision system, which we use to read the extension of the metal wire from the dial indicator. By using the free-of-charge cloud document and the tiny, but powerful, Raspberry Pi workstation, our system is not so pricy and very suitable for the large laboratory classes. We expect that this should help the instructor of the basic laboratory in their tedious but very importance jobs. Our system should also reduce the bias from the different instructors and gives a fair check to the student reports.

Keywords: Raspberry Pi, VBA, M-6





Using Raspberry Pi with camera module as the Rotation Sensor in Basic Physics Laboratory

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We have developed a system that can automatically give a score to a student laboratory report. Even the system can be used in general, we aim our work mainly to the experiment M-4, measuring centripetal force. We take the advantage of the existing Google doc by designing a cloud document for the students to submit their reports. This can be very convenient since the students can submit their works via any platforms of their smart devices. The reports are kept in the form of spreadsheet, which can be analysed by the macro language like VBA or Openoffice.org BASIC. The score is given base on the discrepancy of the results reported by the students and the values from the sensors. We use the single board Raspberry Pi as our workstation to analyse the reports by comparing with the experimental values. As a prototype, we connect our Pi with the camera module to create a motion tracker, which we use to track the rotation of the system. The angular displacement can be tracked, and the angular speed can be measured. By using the free-of-charge cloud document and the tiny, but powerful, Raspberry Pi workstation, our system is not so pricy and very suitable for the large laboratory classes. We expect that this should help the instructor of the basic laboratory in their tedious but very importance jobs. Our system should also reduce the bias from the different instructors and gives a fair check to the student reports.

Keywords: M-4, VBA, Raspberry Pi, Camera module





Synthesis of Magnetofluorescent nanoparticles as a novel platform for bioimaging and cancer cell treatment

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Multifunctional nanoparticles with magnetic and luminescent properties have been generated considerable attention in fields of biomedical applications. In this study, we synthesized and characterized doxorubicin (DOX)-loaded CdSe@amino silica functionalized-Fe₃O₄ (MagSi@Dot) (DOX-MagSi@Dot) nanoparticles as multifunctional platform for drug delivery carries and a promisingly open up fluorescent emission properties. After the end products were synthesized, morphological examination showed nanoparticles with a spherical shape and a diameter of 800 nm. Magnetic characterization demonstrated the superparamagnetic behavior of MagSi@Dot. The loading efficiency of DOX on MagSi@Dot was about 31.08% and shown red emission under UV light at room temperature. In the study of DOX cumulative release from the MagSi@Dot (DOX-MagSi@Dot), it could reach 51.44% in acidic solution (pH=4.5) and 40.37% at physiological solution pH 7.4 within 25 h, showing pH responsive drug release. Cell experiment was also carried out with HeLa cells revealed good biocompatibility at the high concentration of around 250µg/ml and similar cytotoxicity to HeLa cells compared with free DOX drug. These characteristics made the as-synthesized MagSi@Dot an attractive candidate for the controlled release of an anti-carrier drug for magnetic targeted delivery, fluorescence imaging and cancer treatment.

Keywords: Magnetic fluorescent, Drug delivery, Superparamagnetic, Quantum dot, Bioimaging.





The development of device for control temperature in Physics Experiment

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To get an accurate result in some physics experiment, controlled temperature is required, for example, the surface tension coefficient of liquid. The coefficient varies with the temperature, and then controlled temperature is needed to get the best result. For this reason, the development of controlled temperature system is desired. We take the advantage of using the Arduino, microcontroller board with open-source system, as central processing. Temperature is measured by LM35, well-know temperature sensor, which is used as the current control-parameter for a peltier which can generate hot and cold temperature. Then, temperature controlled by PID (proportional-integral-derivative) which famous technique in industrial. Current will adjust for controlled temperature by the best chosen gain in PID. In process of gain choosing, the processing program is used. The system is control temperature in range 20 to 50 Celsius with different in setting temperature less than 1 Celsius.

Keywords: Control temperature, PID controller, Sensor LM35, Peltier





Properties of Co-Cu film prepared by sputtering technique on different substrates

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Co-Cu film with thickness of 312 nm on different substrates (glass, A-PET, C-PET, W-PTFE and B-PTFE) was deposited by RF-sputtering. XRD confirms that all deposited films show Co (HCP) phase in 220 plane, Cu (FCC) phase in 111 plane and Co-Cu (FCC) phase in 111 plane. Intensity of the peak is obviously dependent on substrate material. The highest and lowest peak intensities were observed on the films deposited on C-PET and A-PET substrate, respectively. VSM result reveals that all sputtered Co-Cu films display ferromagnetic phase at room temperature. The maximum and minimum saturation magnetizations in both parallel and perpendicular measurements were observed on the film deposited on A-PET and glass substrates, respectively. The result implies that the structural and magnetic properties of sputtered Co-Cu film can be importantly improved by the material substrate.

Keywords: Co-Cu film, Sputtering deposition, Magnetic property, Structural property





The use of Michelson Interferometer for measure fine length

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To get a best experiment result, fine measuring is required. In this project, we are interested to develop the Michelson interferometer to do an accurate length measurement. We use a 650-nanometer red laser as a light source to get the resolution of 325 nanometers (adjacent constructive fringe). Fine distance is measured by shifted fringes, which we use a microcontroller board Arduino to count them. The shifted fringes are detected by normal light sensor that controlled with this board. We test our system by measuring the wavelength of light source. For 16 measurements, the result show wavelength equal 681.9 nanometers with measurement uncertainty of 4.4 nanometers. The relationship between the numbers of lines of interference of light waves with phase shift is the solution. $\lambda = \frac{2d}{n}$

Keywords: fine measurement, Michelson interferometer, arduino





Fluorescence study of Monosaccharides

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We study photo emission of monosacharrides using laser-induced fluorescence spectroscopy. A 532-nm, 10 mW, laser was use to excite the samples and back-scattering signals were collected by a spectrometer. We found that most sugar show weak fluorescence in solid phase but do not fluoresce in water solutions. The emission spectra show similar peak intensity at 590 nm, but they are different in emission intensities. We suggest that the fluorescence spectra can be used to differentiate sugar type, even though the origin of the fluorescence is unclear and needed further study.





Construction of Low-Cost Wind Turbine Generator

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Wind is a vast potential source of renewable energy. The electricity produced from wind power is safe and clean because its generation produces no greenhouse gas emissions or no pollution during operation. In principle, wind power is converted into electricity from wind turbine generator composed of electromagnetic induction via magnets moving past a stationary coils or a conductor coiled wire moving through a magnetic field. Therefore, the heart of any renewable wind power generation system is the wind turbine. In this work, we have invented a low-cost wind turbine based on a washing machine motor. Toshiba washing machine motor (smart drive motor) with 36 coils was modified to act as a generator of wind turbines. The 3-phase motor was converted to 6-phase motor in order to enhance of electricity and preservation of the voltage drop by the laws of Faraday. The relationship between RPM of constructed generator and produced electricity will be investigated. The effects of numbers of magnetic coils on power generation will be studied systematically.





Assessment of Radioactivity in Soil within the Kasetsart University Bangken campus with High-purity Germanium (HPGe) Detector

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The research main objective is to measure and analyze the specific activities of primordial radionuclides (Ra-226, Th-232, and K-40) in 30 soil samples collected from districts in Kasetsart University Bangken campus. They were measured and evaluated by using a high-purity Germanium (HPGe) detector and gamma spectrometry analysis system at Thailand Institute of Nuclear Technology. The volume standard soil source (IAEA 375-soil) was used to compare and calculate specific activities. The measuring time of each sample is 10,000 seconds. From the experimental data, it was found that the specific activity ranges from 125.82-187.42 Bq/kg for Ra-226, 129.00-192.17 Bq/kg for Th-232 and 2668.90-3975.39 Bq/kg for K-40 respectively. Furthermore, the value of gamma-absorbed dose rate in air (D), radium equivalent activity (Raeq) and external hazard index (Hex) have been evaluated by using the average values of specific activities of primordial radionuclides (Ra-226, Th-232, and K-40) from this study. Moreover, the experimental results were compared to the annual data of the Office of Atoms for Peace (OAP) and, also, global radioactivity measurement and evaluation.





Invention of Real-Time Ammonia Monitoring System

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Ammonia is a toxic gas. Exposure to high concentrations of ammonia, it may result in blindness, lung damage or death. Ammonia detection system is an alternative to prevent the danger as above-mentioned. In this work, we have fabricated a real-time ammonia detection system based on electrochemical gas sensor. The electrical circuits compose of a low power source (3-5 volts) based on MCP1700, amplifier circuits (AD8572, NC358), and analog to digital converter (J177). Electrochemical gas sensor (ME3-NH₃) was used as a receptor. A 5 DC fan was employed to carry the ammonia molecules into sensor chamber. A siren sound was installed for alarm when ammonia intensity reached to a desired value. The constructed ammonia detection system was tested with exposure of ammonia at concentrations of 50, 100, 150 and 200 ppm, respectively. Generated currents from interactions of electrochemical gas sensor and ammonia were recorded every 30 seconds until the current saturation via NI DAQ card. The results show that the current output increases following the intensity of ammonia. The stable currents of ammonia exposure at 50 ppm, 100 ppm, 150 ppm, and 200 ppm are 125.7 μA , 155.6 μA , 210.3 μA , and 260.7 μA , respectively. The effects of distance between ammonia source and the constructed ammonia detection system on generated currents will be investigated.





Identification of Sugar Contents in Soft Drinks using Fourier Transform Infrared (FTIR) Spectra and Statistical Process

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We identify glucose fructose and sucrose contents in soft drinks, using attenuated total reflectance (ATR) FTIR spectroscopy in 900-1200 cm^{-1} range of C-H vibration mode. Principle Component Analysis (PCA) and Partial Least Square Regression (PLSR) were utilized to analyze the carbohydrate spectral and calculate sugars concentrations in various samples. The result shows that this technique can identify the sugar concentrations in soft drinks with accuracy better than 5.5%. Even though, this technique is less accurate than HPLC technique, it is faster and more cost-effective since it does not require constant change of liquid columns like HPLC does.





Structural and Transmission Properties of AZO/Ag/AZO Tri-layer Film

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Al-doped ZnO (AZO) and Ag tri-layer thin films were deposited on glass substrate by RF-sputtering. The thickness of AZO layer at the top and bottom of the film was varied at 35, 50 and 90 nm and the thickness of Ag layer was fixed at 62 nm. XRD result confirms that all AZO/Ag/AZO tri-layer films were composed of ZnO (HCP) phase in (002) direction and Ag (FCC) phase in (111) and (200) directions. Intensity of ZnO phase was directly increased with increasing the thickness of AZO layer. The electrical resistance of the tri-layer film was decreased with increasing the AZO-thickness. The maximum transmittance of about 50% at wavelength of about 400 nm was observed on film at AZO-thickness of 35 nm with average transmission of 24% in the visible region. The film at AZO-thickness of 50 nm shows the highest transmission of about 35% at wavelength of about 500 nm and average transmission of 28% in the visible region. The film at AZO-thickness of 90 nm exhibits the highest transmission of about 28% at the wavelength of about 350 nm and 700 nm and average transmission of 15% in the visible region. It can be concluded that optical transmittance of AZO/Ag/AZO tri-layer film is obviously depended on thickness of AZO layer. It implies that both transmission wavelength and region can be improved by modification of the AZO layer thickness.

Keywords: ZnO:Al film, Sputtering deposition, Structural property, Optical transmission





Hello World Android Application

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Hello World is an educational puzzle game for android learning programming concept. It encourages players to use their intelligence to navigate an adorable little frog to the goal by using commands which imitate the programming concepts like loops, procedures and conditions. Players will learn how to think logically which is the basic of programming. This game differs from another puzzle game because of its adorable way of presentation and interesting story. Hello World consists of three main stages (national, continental, global) with several sub stages. This game not only has the story mode but it also has custom mode where players can create their own stages.

Hello World is developed by using C# programming language, Adobe Illustrator and Adobe Photoshop to design Graphical User Interface (GUI) and Audacity to manipulate background music and sound effects.





“Korpramool” Online auction on website

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The website of online auction (Korpramool) is a website developed from PHP language. The software is designed to apply for the online auction and for the person who wants to bid at an auction. The project was developed by learning from the online auction on various websites. The main objective of the website (Korpramool) is to provide convenience way for people all over the world who want to bid at an auction on their own.

The important function of Korpramool is comparing all prices of the bidders who made offers at one auction. The bidders who propose maximum price in given period will get the goods with their offered price at this auction. In addition for the users to be able to use the program easily, the developer have web browser (www.) to show the results.

Korpramool will be able to help people who are interested in joining the auction to have the utmost benefit. Meanwhile the software will be able help the system controllers to get the profits as they have planned.





“Your Choice” Hotel Application on Android

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Nowadays roughly 90 million people all over the world are using an application to find hotels, and the number is expected to increase extensively in the future. In Thailand, both tourists and Thai people usually use the website to find and search for hotels. But most of them use the PC computers as a mean to do searching. So they are unable to find the hotels when they were outside their houses, on the road or in the middle of their trips. But today, smartphones are taking more role than it used to be as just telephones, now smartphones can be used to search for the hotels. Therefore it is more convenience to navigate to the destinations. “Your Choice” was developed by using the android operating system. It was designed to make it easy to search for the hotels in Thailand so the users can find hotels at any time that they want.

“Your Choice” is an application that runs on android operating system. It is available on smartphones or tablet computers. This application can be used for searching for hotels in Thailand. It enables the users to view photos of the hotels, directs and navigates them to their selected hotel and shows them the hotels’ room rates.





Stratigraphy and Depositional Environment of Sedimentary Rock in Khao Wang Chick Formation atKlaeng District, Rayong Province

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The Khao Wang Chick Formation was exposed in the eastern districts of Rayong Province, especially in Klaeng District. Three opened pits around Klaeng Technical College, Khao Wang Chick and Ban Ta Rue are chosen to study detailed stratigraphy and, finally, interpret the depositional environment of the Khao Wang Chick Formation.

Field study at Khao Wang Chick opened pit reveals a variety of mudstone and siltstone lithologies. Black mudstone, the most prominent lithology, consists of sulfide minerals, such as pyrite. It is overlain by thin-bedded mudstone and siltstone and indicates reducing condition of Khao Wang Chick depositional environment. The exposure at Ban Ta Rue opened pit is composed of black shale instead of black mudstone. This outcrop is interpreted to represent relatively high tectonic activity and strong turbidity current evident from mud rip-up clasts in siltstone. Klaeng Technical College opened pit consists only of pale grey mudstone, which indicates bottom current recorded in contourite deposits. No fossils are found in any exposures.

The large succession of Khao Wang Chick fine-grained sedimentary rocks can be interpreted to represent hemipelagic deposition in deep marine environment. Also, the strong turbidity current recorded in fine-grained sediments could imply a distal submarine fan depositional system.





Seismic velocities of sediment at Taling Chan, Bangkok by a seismic cross hole survey

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This study aims to use crosshole seismic method to study the velocity of the sediment at Taling Chan District, Bangkok using home-made borehole seismic source. Data collection used borehole weight-drop as a seismic sources and hydrophone as a receiver. The results show that the seismic velocities of the sediment in the study area vary from 1000s m/s to more than 2000s m/s which corresponds well to the saturated sand and clay from core data.





Carbon Dioxide Capture and Storage by Mineral Carbonation Using Serpentinite from Ban Sop Pet, Tha Wang Pha District, Nan Province, Thailand

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The natural of serpentinite from Ban Sop Pet, Tha Wang Pha District, Nan Province, Thailand were examined under thin section and scientific instruments to characterize mineral composition. The thin sections showed mineral constituent of serpentine group, pyroxene group, olivine group, chromite and clay minerals. The scientific instruments used in this study consisted of x-ray fluorescence spectrometer (XRF), X-ray diffraction spectrometer (XRD), scanning electron microscope (SEM) and autoclave reactor. Before the reaction, chemical composition and mineral constituent of serpentinite were analyzed by XRF and XRD, respectively. The result from XRF showed element composition of SiO₂ 31.2-54.7Wt%, MgO 28.3-48.1Wt%, CaO 4.1-13.6Wt% and Fe₂O₃ 4-11 Wt%. The XRD showed mineral peak patterns of actinolite, augite, edenite, antigorite, lizardite, chromite, illite, diopside, chrysotile and calcite. The serpentinite was reacted with CO₂ under the condition of 50 °C and 60 bar with the duration of 10 days. After reaction, type of product minerals were examined by XRD while their morphology were examined by SEM. The result showed the reaction products was a mixture of hematite (Fe₂O₃) and olivine ((Fe, Mg)SiO₂). However, the expected products for instance magnesite, calcite or siderite do not formed. This possibly due to the conditions used in this study are either not sufficient or inappropriate i.e. pressure and duration or lack of catalyst. Further research is therefore needed to be carried out in order to reach the purpose.

Keywords: Carbon Dioxide Capture and Storage, Mineral Carbonation, Serpentinite





Slope Stability Analysis of Kong – Nakornratchasima Transmission line in Kong District, Nakornratchasima Province

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The propose of this research is to study the stability of soil of the Kong – Nakornratchasima Transmission line in Kong District, Nakornratchasima Province. The studying was consisted of topography, geology, drill holes data, engineering properties of soils and also slope characteristic data from the study area. Moreover, the program of KU Slope 2.1 to find out the soil failure model and the factor of safety of the study area were pursued. The results showed that the geology of the study area is the Quaternary unconsolidated soil. According to soil profile, the existed soil can be divided at least three layers. The first layer was a layer of loose silty sand (SM) which found at a depth of 1 to 3 meters, the second layer was a layer of medium dense clayey sand (SC) which found at a depth of 3 to 5 meters and the third layer is dense-very dense clayey sand (SM) which found at a depth of 5 to 7 meters. From the direct shear test, the internal friction angle of soil was within the range of 22 to 40 degrees and the cohesion of soil fell within the range of 0.5 to 1.9 tons per square meter. Moreover, the factor of safety was about 1.9 to 2.2 which indicated that this area was stable for slope stability.

Keywords: Slope Stability, Factor of Safety, Direct Shear Test, Strength Parameter





Clay Seam Mapping for Landslide Risk Zoning by Resistivity and IP Measurement at Ban Phadeh School Area, Phatatpadaeng Subdistrict, Maesot District, Tak Province

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Landslide hazard in Thailand is a natural disaster which affects human life and asset. Landslide hazard happened inside Ban Phadeh School area at Phatatpadaeng Subdistrict, Maesot District, Tak Province which caused one school building collapse. The cause of ground movement due to shallow thin clay seam saturated with water from heavy rain. Damaged zone have been improved by engineering technique and new school building has been rebuild at nearby previous location. Resistivity and IP measurement were applied to investigate subsurface geological characteristics to locate clay seam layer that may repeat landslide occurrence in this region. Due to high terrace topography of survey area, six survey lines with 235 m long and 5 m electrodes spacing are located in N-S and W-E directions covering the whole school area of about 270 x 290 m. Three technical approaches were conducted in variety purposes i.e. 2D inversion model by 2D resistivity and IP imaging technique with DP-DP electrodes configuration for detailed shallow section. Then 1D inversion model by scanning technique with Schlumberger configuration for deeper vertical resistivity change. Lastly surface resistivity and IP mapping with gradient technique by locating C_1C_2 spacing of 450 m and $P_1 P_2$ spacing of 20 m with resolution of 5 m. The result of 2D inversion model can indicate clay seam layer presenting as low resistivity ($<10 \Omega m$) and high IP ($>10 \text{ mv/v}$) at the western boundary of school area with depth of 5 m and about >30 m wide. 1D models confirm clay layer with the thickness of 5 m. Various clay layer zone can be located by resistivity and IP mapping at the front of the school and at previous damage zone.





Characteristic of aggregate rock in the Lower Central Thailand

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The construction aggregate industries are important in the lower central Thailand. Almost the aggregates are distributed in the central Thailand which included Bangkok. This research aims to study the physical and chemical of aggregated rocks in the lower central Thailand. The 46 rock samples were collected from 6 provinces (Chainat, Uthai thani, Phetchabun, Nakornsawan, Suphanburi and Saraburi). The rock samples were identified to be the alteration volcanic rock, limestone, dolomitic limestone and sheared rock by petrography, X-ray Diffractometer (XRD) and X-ray Fluorescence (XRF). The chemical components and mineral crystals were informed the qualities of aggregates from the lower central Thailand which could be used in different kinds of construction such as highway, house and skyscraper.





Investigated Resistivity and IP Techniques to Identify Sand Deposit Boundary

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Sand resources are important in construction industry. Majority of sand resources are generally used as construction material. A significant sand resource is situated at the northern Chao Phraya Basin, Ayutthaya province due to good quality and convenient transportation to Bangkok. Resistivity and IP measurements are applied to study occurrence of sand deposits and to locate boundary of sand and clay layer. Four surveys line were design in N-S direction with 235 m long, 50 m line spacing and 5 m electrodes separation covering the area of 250 m x 235 m. New design of Electro-porous electrodes was introduced for both of transmitters and receivers of resistivity and IP measurement. Four techniques were attempted for different targets as follows; First, Resistivity and IP measurements were taken to locate sand and clay layers to depth of 25 m with Dipole-Dipole configuration. Second, Scanning technique was conducted to analyze in vertical change with Schlumberger configuration at target depth of 40 m as 1D model. Third, resistivity and IP surface mapping were performed to locate sand deposits boundary with the gradient array by locating C_1C_2 separation of 1,235 m and P_1P_2 spacing of 20 m with resolution of 5 m. Lastly, 3D resistivity and IP offset pole-dipole approach have been attempted to investigate sand and clay deposits in 3D form. The result of 2D resistivity and IP inversion models can classify sand and clay layer (zone). Clay layer presents as more slightly lower resistivity ($>10\Omega m$) but much higher IP ($>10 mV/V$) value than sand layer. A higher resistivity zone model (resistivity of sand layer) conforms to the result of 2D section. But sand and clay layer can be identifying as 3D model can display sand and clay layer in 3D view. Modifying resistivity and IP techniques can be successfully investigated sand and clay layer.





Water Quality of Hot spring water from Ban Mueangrae Hot Spring at Mueang Pang, Pai, Mae Hongson

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Physical and chemical properties of hot spring water including flow rate of hot spring were studied at Ban Mueangrae Hot Spring, Mueang Pang, Pai, Mae Hongson. This hot spring was newly found in August, 2013. Therefore, it is of primary interests to study overall properties for further utilization and development. The study plan included area survey, and water sample collection 2 times in August, 2014 and February, 2015. The hot spring water were measured according to WHO drinking water standard (2006) and Industrial drinking water standard (Ministry of Industry, 2006); including standard surface water in Pai River flowing passed by the Hot Spring.

The results of physical and chemical properties of hot spring water lied in Standard limits excepted alkalinity which higher than standard and could not be used as drinking water. This hot spring has high temperature up to 95 degree Celsius with flow rate 12.17 liters per second, or 1,000 cubic meters (m³) per day. Therefore, this hot spring has high potential to use geothermal energy for many utilization. The analysis of surface water quality in Pai River showed very good quality of standard surface water type1 (Pollution control department, 1994).

As a conclusion, this newly found Hot Spring has high potential to promote tourism to the areas including further development for other geothermal energy utilization as well.





The Characteristics of Sapphire Samples from Sri-Lanka and Thailand

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The geology of sapphire occurrence can be divided into 2 types, which are associated with metamorphic and basaltic rocks. The different characteristics of sapphire samples depended on the geological origins and their occurrences. This research studied characteristics of sapphires from Sri-Lanka (associated with metamorphic rocks) and Thailand (associated with basaltic rocks). The physical properties of sapphire samples show the similar results such as refractive index (RI), the optical characteristic, pleochroism and specific gravity. However, the different fluorescent colors under UV lamp can be observed clearly in each origins. Mineral inclusions, healed fractures (fingerprint) and color zoning are commonly seen within sapphires from Sri-Lanka and Thailand under microscope. Needle-like inclusions are observed in sapphire samples from Sri-Lanka, but are not commonly seen in sapphires from Thailand. Additionally, not only the difference of characters and inclusion pattern between sapphires from Sri-Lanka and Thailand, but also the results of advance instruments such as FTIR, UV-VIS-NIR and EDXRF are absolutely diverge. Accordingly, the results of advanced instruments can be separated the sapphire origin by the position peaks of absorbance or transmittance spectrum and quantity of chemical composition as well.





Water Footprint study for the development Hot spring Model in the Western part of Thailand

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The study of water footprint is a new modern investigation idea to trace water usage activities included water usage quantity, times and places where water was used. Water footprint studies for development of hot spring model in Western part of Thailand were assigned to Hindad hot spring, Kanchanaburi; Nong Ya Plong hot spring, Phetchaburi and Huai Nam Nak hot spring, Tak. Water supply rate from origin wells and water usage activities in each area were measured; including water qualities of hot spring water were analyzed based on the standards for drinking water of World Health Organization, 2006. These data were used as guide line for suitable and best utilization of hot spring water.

The results of study for water supply rates were 501.12, 181.44 and 145.152 cubic meters (m³) per day in Hindad hot spring, Nong Ya Plong hot spring and Huai Nam Nak hot spring respectively. The present water quantity can cover the uses for hot spring water bathing, general household utility of communities. With increasing demand of water usage such as Nong Ya Plong Hot Spring, the water usage during 2011-2014 increased 87.85 percent. Therefore, future plan for water usage should be taken in to serious consideration. The physical and chemical water qualities of all three hot springs were in standard hot spring water suitable for healthy bath and spa including production of mineral drinking water. This research study can be used as information for hot spring water management and health tourism development of the communities.





Monitoring of species and concentration of polycyclic aromatic hydrocarbons contaminated in seawater and soil sediment from oil spill accident around Koh Samet, Rayong Province

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Polycyclic aromatic hydrocarbons (PAHs) are persistent organic pollutants composed of two benzene rings or more. It is the main components in petroleum products. USEPA has determined 16 PAHs which had the mutagenic and carcinogenic properties. This research focused on tracing species and concentration of PAHs in seawater and soil sediments in the areas around Koh Samet, Rayong Province where oil spill accident occurred. Fourteen samples each of seawater and soil sediments were collected in February, 2014. The seawater samples were extracted by Solid Phase Extraction (SPE C-18) and soil sediment samples were extracted by high frequency sonication. Species and concentration of 16 PAHs were analyzed by High Performance Liquid Chromatography (HPLC).

The results found that total PAHs in seawater was between 0.48-30.23 $\mu\text{g/l}$ with average value of 10.656 $\mu\text{g/l}$ and in soil sediments were between 0.132-7.846 mg/kg with average value of 2.945 mg/kg. AoaWai had highest value above the proposed standard for coastal sediment (2015). Comparison of PAHs in seawater from this study with Kittiya (2013) in same area demonstrated decreasing values but increasing in soil sediments. Most abundant PAHs in seawater were Cabazole, Naphthalene and Fluoranthene while PAHs in soil sediments were Cabazole, Anthracene and Fluoranthene.

Therefore the tracing study of PAHs contamination from this research can be used to evaluate the environmental effects in the long run and to initiate rehabilitation the environment of Koh Samet more efficiently.





Mineralogy and Metamorphism Condition of Corundum bearing Marble from Elahera area, the Highland Complex, Sri Lanka

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The objective of this research is to study the metamorphic evolution of high grade metamorphic rocks in Highland Complex, Srilanka. The mineral constituent of rock samples were examined using Polarizing microscope, rock-forming minerals and whole –rock chemical composition are analyzed by X-ray fluorescence (XRF) and Electron Probe Micro Analyzer (EPMA). The sample's geochemistry use to calculate the temperature and pressure condition by using thermodynamics computer program to create psuedosection model. From petrographic identification, the marble which is coarse-grained, granulated texture composed of calcite, spinel, orthopyroxene, muscovite and corundum, while Charnockite composed of orthopyroxene, plagioclase, quartz, garnet, biotite and muscovite. The results from thermodynamics model reveals the temperature yield from 933-960 C⁰ while pressure reached 9.0-9.6 kBar. From the whole study suggested that Marble and Charnockite in Elahera area could be metamorphosed under the granulite facies condition consistent with corundum occurrence sources .





Shallow Marine Seismic Survey Applied to Extended Faults Exploration in Manao Bay Area, Prachuapkhirikhan

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This study conducted shallow seismic reflection in Manao Bay area where Ranong fault's extension was inferred to be located. This fault's extension might increase seismic hazard level of Bangkok and suburban in the future.

The seismic survey used 24-channel streamer which can provide high resolution seismic image of the subsurface. The raw data from 15 km offshore track line is enhanced through processing steps such as frequency filtering, SRME, deconvolution and migration. The result shows no shallow fault evidences in this area, it might due to limitation of the seismic source that cannot penetrate deep enough to detect the deep faults. However, the shallow structures such as buried channels and unconformities can be clearly observed from the seismic section. The data acquired using sparker source can cover good image of 200ms in length. For deeper coverage, the seismic survey should use a lower frequency source such as mini-airgun for deeper penetration.





Comparison of Tertiary sediment at Baan Pong subdistrict, Hang Dong district, Chiang Mai province and Quaternary sediment at Nam Cha subdistrict, Muang district, Phrae province

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This research aimed to study the significant difference between Quaternary and Tertiary sediment. This study investigated two sub-basin depositions from Chiang Mai and Phrae provinces. Ban Pong Nua site was located in Ban Pong sub-district, Hangdong district of Chiang Mai which was selected as the Tertiary sedimentary investigation area, a sequence of samples used to create sedimentary stratigraphy. The sediment in Quaternary basin was located in Ban Nam Cha, Nam Cha sub-district, Mueang Phrae district of Phrae which samples were collected for Thermoluminescence (TL) dating to determine the ages of the Quaternary depositions. Both quartz and feldspar were extracted from the fluvial environment deposit to create the sedimentary stratigraphy and chronostratigraphy.

Ban Pong Nua site, the result of sedimentary stratigraphy provided the fining upward sequence bed (gravel layer, thin layer of very fine sand, silt to clay layer). There were peat layers (each 30-60 cm thick) and the lignite seam (each 60-100 cm thick) interbedded with clay. Paleoenvironment interpretation based on the sedimentary stratigraphy was the lacustrine deposit. Ban Nam Cha site of Phrae, the sedimentary stratigraphy consisted of the thick layers of gravel (100 – 150 cm thick) and silt to sand layers. The paleoenvironment was the lake delta deposits. As a consequence, Quaternary sediments are suitable for using the TL-dating and the age determinations of depositions are in the Pleistocene epoch.





Mineral Carbonation of Perlite from Lamnarai Subdistrict, Chaibadan District, Lopburi Province

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With ever more natural disasters linked to global warming, it becomes imperative to find solutions to this problem in a productive, efficient, and relatively cheap way. Many have come up with solutions or ideas but some are either too expensive to produce or too time consuming and will not solve the problem in a speedy manner. Although, this project will address one solution to help stopping global warming using cheap material like perlite and this process might also solve the problem efficiently if given the right resources and time. As scientist today around the world try to figure out the best possible way to trap CO₂ sequestration, one possible solution is to use magnesium, which can be attained through perlite. In order to achieve the trapping of CO₂ sequestration, we must have the ability to build and maintain a reactor that can sufficiently take the magnesium out of perlite, which the reactor must have, abundance or a reliable source of perlite since there is only a small amount of magnesium in perlite. If there is a lack of perlite, then there might not be enough magnesium to offset the CO₂ sequestration, which is known as a main factor in the global warming crisis. Luckily, it does not take to much force or effort to successfully attain magnesium through perlite. But, it can be a difficult process using perlite, if of course the reactor being used does not have the right calibration to successfully extract the magnesium. The reactor must be at least 50 degrees Celsius and a pressure system of 60 Bar. In addition, the location of the reactor does not depend necessarily where a great amount of CO₂ is being released. For example, cities, factories, or large work sites where heavy CO₂ combustion is required. Reactors do not need to be in certain vicinity related to the examples stated before, because once the reaction takes place with the dissolution of magnesium from the perlite, the magnesium can trap the CO₂ in the air, which of course will bring down levels of CO₂ sequestration and thus stopping effects of global warming. Clearly, it does not take an extraordinary amount of energy to release the magnesium out of perlite and location is not a high priority, which could make the method of using perlite extremely cost effective to combat the ever growing global warming issue that most countries and scientists agree should be addressed.





Geology for developing geotourism related to gem deposit at Nam Yeun, Ubon Ratchathani

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This research aims to study the geomorphology and geology for developing geotourism related to gem deposits at Nam Yuen, Ubon Ratchathani province. The research studied landform and geology by remote sensing, ground survey and identified the mineral compositions using a polarizing microscope. Geomorphological interpretations were consisted of the mountain unit, alluvial fan unit and fluvial deposit (floodplain) unit. The mountain unit included sandstone and basalt. This investigation area found some gemstone such as corundum, zircon and some other gem minerals, in the fluvial deposit unit at Ban Non-Yang, Ban Ta-Koi and Ban Non-Sangphet. Nam Yuen area is very attractive to the new potential tourist place as geotourism in Ubon Ratchathani province.





Reflection Seismic Investigation for the New Hot Spring at Ban Mueang Rae, Amphoe Pai, Mae Hong Son, Thailand

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This research aims to study subsurface geology with reflection seismic investigation for the new hot spring at Ban Muang Rae, Amphoe Pai, Mae Hong Son, Thailand. Geophysical survey consists of two seismic lines (about 500 m each) perpendicular to each other with the hot spring is the center of survey lines. The hammer and weight-drop were used as seismic sources. Data processing includes pre-stack time migration shows the imaging of sediments, presumably sand layers (velocity about 600 m/s in velocity analysis) with thickness of 30 m overlaying fractured granite bedrock. There is no clear boundary between sediment and bedrock.





Species and concentration of polycyclic aromatic hydrocarbons (PAHs) contaminated in sea water and soil sediment from oil spill accident around coastal areas of Map Ta Phut Industrial community, Rayong province.

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Polycyclic aromatic hydrocarbons (PAHs) are persistent organic pollutants that can cause mutagen and cancer. The tracing study on contamination of PAHs from 27 July, 2013 oil spill accidents were determined to identify species and concentration in sea water and soil sediment. Sea water and sediment sample were collected from 16 locations in February, 2014. The sea water samples were extracted by solid phase extraction (SPE C-18) and soil sediment samples were extracted by high frequency sonication. Species and concentration of 16 PAHs were analyzed by HPLC (High Performance Liquid Chromatography; column: C-18, mobile phase; acetonitrile:water = 70:30)

The results of this study found that total PAHs in the sea water were between 0.66 - 14.88 $\mu\text{g} / \text{l}$ with average 4.50 $\mu\text{g} / \text{l}$. The total PAHs in soil sediments were between 0.07 - 17.58 mg / kg with average 7.33 mg / kg . Comparison the result from this study to Pimpisut (2013) studied in the same area appeared that PAHs in sea water decreased significantly and was in standard limit of sea water class 5 (sea water for industry and harbor), But the PAHs in soil sediment showed potential to increase and were in standard limit for warning to contaminated by the proposed standard for coastal sediments by Pollution Control Department (2015). The most abundant PAHs species in sea water were fluoranthene, anthracene and chrysene, respectively. The most abundant PAHs species in soil sediments were cabazole, fluoranthene and chrysene, respectively.

Therefore, the tracing study of PAHs contamination from this research can be used to evaluate the environmental effects in the long run and to propose rehabilitation and development industrial areas for better environment.





Geoarchaeology of Baan Dong Muang Toey archaeological site, Yasothon province

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Dong Muang Toey excavation site is located in Song Puey sub-district, Kum Kuen Kaew district, Yasothon province in the northeastern Thailand. Dong Muang Toey archaeological site has revealed a lot of ancient potteries and slags. From the study, archaeologists believe that Dong Muang Toey potteries were crafted in prehistoric period. This research can be divided into 5 layers of sediments from the excavation site include the layer which contains ancient potteries to determine the age by Thermoluminescence (TL) dating method. Furthermore 5 specimens of ancient potteries and an iron slag derived from the site were identified the mineralogical and micro-structural compositions by Petrography and Scanning Electron Microscope with X-ray Microanalysis (SEM/EDS), X-ray Diffraction (XRD) was used to confirm the mineralogical compositions and chemical elements. All samples were produced in a very similar manner in terms of the methodological approach to the technology and the ingredients used. Quartz is the main compound in ancient potteries. Iron, silica and alumina oxide are the main compounds in the slag. The slag contained fayalite, hercynite and quartz.





Characteristics of Cenozoic basalt at Den Chai district and Wang Chin district, Phrae province

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Den Chai is well known as the blue sapphire which associated the basaltic rocks. The geologists often reported the Den Chai basalt was the alkali basalt. This research aims to study physical and chemical characteristics of basalt in Den Chai district and Wang Chin district, Phrae province. A survey of this area showed that the majority of basalt flows over multiple layers, which could be divided into four groups. There were different in mineral compositions, mineral contents and occurrences time. The data also showed that this area were sedimentary basins and had fractures caused by tectonics, then molten lava repeatedly extruded through the fractures and covered the sediment on the surface time by time. Finally, the lava landform formed the geology of Den Chai district and Wang Chin district.

By geological survey in Den Chai district and Wang Chin district found sapphire, ruby, black spinel, zircon etc. These gem minerals were transported and deposited in streams and ground surface, which researcher hope that it could be develop in to mining industry.





Relocating the 2014 ChaingRai aftershock earthquakes (<M 2.0)

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This study aims to relocated 5 days of recorded of the M 6.1 earthquake occurring in ChaingRai on May 5th, 2014. The data were recorded by 7 seismic stations operated by Kasetsart University, *Thai Meteorological Department*, Department of Mineral Resources and were processed with SEISAN and HypoDD programs.

The results of relocated earthquakes show a clear trend of fault ruptures and cluster of aftershocks. There are 278 aftershocks with magnitude smaller than 2. There are 287 aftershocks with magnitude between 2.1 and 3. There are 67 aftershocks with magnitude between 3.1 and 4. There are 8 aftershocks with magnitude between 4.1 and 5.





Petrography and Geochemistry of High-grade Metamorphic rocks at Doi Suthep Chiang Mai Province Thailand

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This research aims to study the metamorphic evolution of high-grade metamorphic rocks at the Doi Suthep area, Chiang Mai Province. The methodology of this study comprising fieldwork investigation, collecting rock samples and laboratory works including rock-forming identification using Polarizing microscope. Whole-rock chemical compositions of rock sample were analyzed by X-ray Fluorescence Spectrometer (XRF). In addition, mineral chemistry was carried out using electron probe microanalysis (EPMA). These chemical data will be used to calculate the temperature and pressure of metamorphism of high grade metamorphic rocks in the study area using thermodynamic pseudosection modeling and classical P-T calculation.

Petrographic study reveals that high grade metamorphic rocks at Doi Suthep are mainly medium to coarse-grained and show a strong deformation textures with local mylonite. They are predominantly consisted of K-feldspar, plagioclase, muscovite, quartz and subordinate garnet. According to pseudosection modeling, the rock samples were metamorphism at a range of temperature of approximately 435-515 K, but the pressure could not be determined because the stability field of an observed mineral assemblage is too broad. Consequently, classical calculation based on mineral chemistry is need to be added in order to restrict the range of P-T. Thus, field evidences, mineral assemblage, texture and preliminary geochemistry suggest that metamorphic rocks of Doi Suthep area, Chiang Mai Province have experienced a metamorphic condition of approximately amphibolite facies which is fairly high.

Keywords: Petrography, Geochemistry, Doi Suthep, High-grade metamorphic rock





Monitoring of Species and concentration of the Polycyclic Aromatic Hydrocarbons (PAHs) in seawater and soil sediments from oil spill accident around coastal municipal area Rayong Province

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Polycyclic Aromatic Hydrocarbons are a group of important organic pollutant. And should concerned General sources of PAHs are contamination of petroleum hydrocarbons and incomplete combustion of organic compound. The recalcitrance of these compounds depends on the arrangement of benzene rings and their molecular weight. The study is to monitoring the PAHs contamination and their types in sediments and seawater samples from Rayong's coastal residential area after the oil spill incident in July 27,2013 and to see the changes of PAHs contamination in the early spilling. Sediment and sea water samples were collected for 30 stations. The sea water samples were extracted by solid phase extraction (SPE C-18) and soil sediment samples were extracted by high frequency sonication. And analyzed the type and amount of PAHs compounds with High Performance Liquid Chromatograph; Colum: C-18, Mobile phase; Acetonitrile: water = 70:30

The results revealed the PAHs contamination rates are approximately 0.225-7.165 μ / l. (Average 3.104 μ / l). In seawater sample and 0.052-4.598 mg / kg (average 3.103 mg / kg) in sediment sample. Compared to the research of Pimphisut (2013). The contamination in the same study area is still high and likely to increase in sediments due to society's activities but tend to decrease in the sea. The most common PAHs in the sea are Cabazole, Naphthalene and Fluoranthene and the most found in sediments are Cabazole, Anthracene and Fluoranthene. Plans to prevent environmental impact in long term and to restore coastal environments are mandatory.





Heavy metals absorption using expanded perlite

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Wastewater from homes and industries are a major cause of water pollution, especially water pollution caused by contamination of dyes and heavy metals. Contamination of heavy metals in water is an issue causing a large amount of problems for health reasons and for agricultural reasons. The purposes of this study are to study the properties and to investigate the ability of expanded perlite. To absorb the heavy metals from solutions of Perlite, siliceous volcanic rock, can be found in Lopburi Province, Central Thailand.

In this study, the expanded perlite was used to remove of lead, manganese and zinc ions from solutions. The experiment indicated that perlite can be used as an absorbent for heavy metals.





Piezoelectric property in Quartz, Topaz and Tourmaline

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Quartz, tourmaline and topaz are the minerals, exhibiting piezoelectric property. This study involves an alteration of mechanical force and electrical energy in piezoelectric material. The work compares the 3 kinds of crystals, i.e., electrode quartz, topaz and tourmaline. To study the properties of transforming mechanical force into electrical energy, the samples were prepared using thin film coating technologies called the thin film deposition process before the experiment. Then, the static dielectric piezo d_{33} was measured. Piezoelectric constant, a quasi-static method by means of the property of piezoelectric matrix, can be seen from the d_{33} , and then the study can be found. Also, tourmaline shows about 7.4 Q / N of a d_{33} , which is higher than quartz and topaz showing 3.2 Q / n and 4.6 Q / n of a d_{33} , respectively. For piezoelectric material, the matrix requires a high d_{33} to be further equipped and amplified with vibration and movement so that tourmaline's properties of piezoelectric is the best potential to use. The database on application of piezoelectric material in electronic devices requires further study to completely understand all applications of piezoelectric material.





Groundwater Quality Assessment for Mineral Water of HinDat Hot Spring, ThongPhaPhum, Kanchanaburi Province

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Mineral water is the water from a mineral spring that contains various minerals. Mineral water contains essential minerals such as iron, calcium and magnesium. It can be used to cure diseases, lose weight, improve bone health, lower blood pressure, better skin and other benefits. Traditionally, mineral water is to be used or consumed at their spring sources without treatment. The HinDat hot spring is located at Thong PhaPhum District, KanchanaBuri Province. The objective of this research was to analyze the physical and chemical of water quality from HinDat hot spring. The results of study showed that the values pH was about 6.85, total dissolved solid was about 490 mg/l, the electrical conductivity was about 839 $\mu\text{s}/\text{cm}$, sulfate, chloride and nitrate were about 118.49 mg/l, 4.94 mg/l and 0.15 mg/l, respectively. Moreover, total hardness was 452 mg/land can be considered as very hard water. When comparing the quality of water to the standard mineral drinking water, it is found that all parameters fell within the standard limit. However, the quality of HinDathot spring is appropriate for the mineral drinking water after water quality improvement.

Keywords: Groundwater, Quality, Hot spring, Hydrogeochemistry, Mineral water, HinDat





Mud Spa in Huai Nam Nak Hot Spring, Phob Phra District, Tak Province

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At present, mud spa has become more widely popular among both of the eastern and western countries. The mud spas' sources are usually rich in minerals and the mud is often used for various treatments. The Huai Nam Nak hot spring is located at Phob Phra District, Tak Province. The aim of this study was to characterize the physical and chemical of mud from hot spring. Seven mud samples around hot spring were collected. The results of grain size analysis of mud samples were revealed that the soils of the study area are medium to moderately fine-textured soils. They can be classified as loam soil. The result of the pH values range between 7 and 8.4. The percentage of soil organic matter content ranged from 4.0 to 4.2. The bulk density range from 0.7 to 1.3 g/cm³. The cation exchange capacity of the soil samples ranged from 4.2 to 4.73 cmol_c of soil whereas the percentage of base saturation range from 45 to 53 which indicating the alkaline soil. The main mineral composition is calcium carbonate (CaCO₃). The higher concentration of calcium carbonate in Huai Nam Nak mud can acts as a soft disinfectant that helps relieve the itchiness and skin irritation caused by acute and chronic skin inflammation.

Keywords: Mud Spa, Hot Spring, Hot Pool, Huai Nam Nak





Petrography and Geochemistry of High-grade Gneiss and Corundum-bearing Mafic Skarn from Highland Complex, Sri Lanka

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The aims of this research is to calculate temperature and pressure conditions of the metamorphism of high grade metamorphic rocks from the Highlands complex, the middle of Sri Lanka in order to constrain the metamorphic evolution that related with the genesis of corundum in skarn. P-T conditions were calculated based on thermodynamic modeling using chemical composition of mineral constituent and chemical composition of whole rocks.

In this study, four representative samples were selected from all collected samples, 2 samples of skarn and 1 samples of charnockite. Petrographic identification reveals that skarn which is coarse-grained and black color, composed of corundum, biotite, clinopyroxene, calcite, scapolite and cordierite. While charnockite composed of garnet, biotite, muscovite, clinopyroxene, plagioclase and quartz. Analysis of the whole rock chemical composition using X-Ray Fluorescence Analysis (XRF) and the mineral chemistry by Electron Probe Micro Analyzer (EPMA) could be used for calculation of the temperature and pressure conditions during metamorphism of charnockite and genesis of corundum in skarn from Sri Lanka.

The results indicate that both of skarn and charnockite from study area were metamorphosed under granulite-facies condition which is consistent with other well-known metamorphic belts in the world that related with the occurrence of corundum for instance Tanzania-Madagascar.





Petrography and Geochemistry of High-grade Metamorphic Rock at Mae Wong National Park, Khampaeng Phet Province

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The objective of this research is to study the P-T conditions of metamorphism of high-grade metamorphic rock at Mae Wong National Park and adjacent area. The mineral constituent of rock samples were examine dusing Polarizing microscope. Whole-rock chemical composition and chemical composition of rock-forming minerals were analyzed by X-ray fluorescence (XRF) and Electron Probe Micro Analyzer (EPMA), respectively. Both whole-rock chemistry and mineral chemistry will be used for temperature and pressure calculation using thermodynamic programs to create psuedosections model.

The result of field workand petrography suggested that metamorphic rock in the study area is predominantly mylonite which consists of feldspar, quartz ribbon, plagioclase, and biotite however garnet locally occurs in some area. Anatexite or migmatite was also found at the northern side of the Khlong Nam Lai Dam. It shows a close relationship with fine-grained leucogranite which could be interpreted that migmatite has partially melted and the resulting melt crystallized to be leucogranite. Migmatite shows high deformation, very coarse-grained texture and predominantly consists of feldspar, biotite, quartz and plagioclase while the fine-grained granite consists of quartz, feldspar and muscovite. Garnet-bearing calc-silicatesalso found in this area. Based on lithology and field evidences, metamorphic rocks in the Mae Wong National Park and adjacent areas could be metamorphosed under upper-amphibolite to granulite facies condition.





Hydrogeological of HuaiNamNak Hot Spring, PhopPhra District, Tak Province

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The purpose of this research is to study the hydrogeology of HuaiNamNak Hot Spring, PhopPhra District, Tak Province in order to determine the relationship between geological characteristics and hydrogeological characteristics of HuaiNamNak Hot Spring and adjacent area. The study area extends over some 133 square kilometers. This studying has been focused on geologic setting, hydrogeologic setting and groundwater quality following 4 main parts; (1) Gathering Data (2) Site investigation (3) Physical and chemical of groundwater analysis (4) Report writing.

The result of study reported that the geology of the study area consists of sedimentary rock of Permian in age which including limestone, dolomitic limestone, sandstone and mudstone in the northern and eastern part of the study area. In the western part, it is found granite intrusion of Triassic in age. The rest area is covered by Quaternary sediments. It should be remarked here that, travertine is found within the hot springs and adjacent area. Evidence of structural geology is not found. Expected possible heat sources come from the granite intrusion in the western part of study area.

The groundwater flow corresponds very well with the flow direction of surface water from the west to the east of the study area. Two main aquifers are identified: unconsolidated and consolidated aquifer. Unconsolidated aquifer consists of Flood-plain aquifer (Qfd) and Colluvial deposit aquifer (Qcl) which is found on average of 15 meters depth. Consolidated aquifer consists of Permian Carbonate aquifer (Pc) and Granitic Aquifer (Gr) which is found on average of 35 meters depth. In terms of groundwater quality, the pH value ranges between 6.2 and 8.0. The electrical conductivity range from 107 to 775 $\mu\text{S}/\text{cm}$, total dissolved solids ranges from 76 to 430 mg/l whereas total hardness ranges from 74 to 494 mg/l. The water quality of the HuaiNamNak Hot Spring is expressed as the hard water.

Keywords: Hydrogeology, Hot Spring, Groundwater, HuaiNamNak





Hydrogeology of HinDat Hot Spring, ThongPhaPhum District, Kanchanaburi Province

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The purpose of this research is to study the hydrogeological of HinDat hot spring in Thong PhaPhum District, Kanchanaburi Province in order to determine the relationship between geological characteristics and hydrogeological characteristics of HinDat Hot Spring and adjacent area. The study area extends over some 64 square kilometers. This studying has been focused on geologic setting, hydrogeologic setting and groundwater quality following 4 main parts; (1) Gathering Data (2) Site Investigation (3) Physical and Chemical of groundwater analysis (4) Report writing. The result of study revealed that the geology of study area consists of sedimentary rock of Permian in age which including limestone, dolomitic limestone, sandstone and mudstone in western and eastern part of study area. The rest area is covered by Quaternary sediments. The groundwater flow corresponds with the flow direction toward to the KwaiNoi River. Two main aquifers are identified: unconsolidated aquifer and consolidated aquifer. Unconsolidated consists of Colluvium deposit aquifer (Qcl) which is found on average of 30 meters depth. Consolidated aquifer consists of Permian Carbonate aquifer (Pc) which is found on average of 90 meters depth. In terms of groundwater quality, the pH value ranges between 6.13 and 7.13. The electrical conductivity range from 370 to 847 $\mu\text{S}/\text{cm}$, total dissolved solids ranges from 106 to 490 mg/l whereas total hardness range from 205.4 to 784 mg/l. The water quality of HinDat Hot Spring is expressed as the hard water.

Keywords: Hydrogeology, Hot spring, Groundwater, HinDat, Kanchanaburi





GPR Survey for detecting the old structure at WatMaiThongsen Dusit, Bangkok, Thailand

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GPR investigation has been conducted at Wat Mai Thongsen, Dusit, Bangkok, Thailand. This work is aimed to trace the ancient wall which is buried under the new structure. The GPR survey is conducted along the hall way between the church and newly built wall using 400 MHz antenna. GPR data processing consists of low frequency removal, band pass filter, gain correction and background removal. Processed GPR data show trends of possible buried structures which corresponds to the location of the ancient wall surrounding the church.





Analysis of Queuing System for Cash Card Exchanging Service: A Case Study of the ScKU Food Court at Kasetsart University

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The ScKU food court is a food court where it is served to a lot of customers. Before the customers buy food or drinks, they have to exchange cash to card. After collecting data by questionnaires it is found that during 11.00 a.m. – 01.00 p.m. is the best time for customers to come to this food court.

The results of the study during 11.20 a.m. – 12.30 p.m. show that for the current system during 11.20 a.m. – 12.00 p.m. the arrival rate is 9.5975 persons/min and during 12.00 – 12.30 p.m. is 10.770 persons/min. Consequently, the average of the service rate is 8.5391 mins/person. The purpose of this research is to compare the efficiency of three systems by simulating. The system including 1) the current system with 2 service units and 2 waiting lines 2) the first new system with 3 service units and 3 waiting lines and 3) the second new system with 3 service units and 1 waiting line. The results obtained from 100 independent simulations reveal that the average number of customers in waiting line of the current system, the first new system and the second new system are not different that is 3.615 , 3.829 and 3.754 persons/min respectively. However, the average time that a customer spends to wait in line, of first new system and the second new system are nearly the same that is 5.242 and 5.242 seconds respectively. From the results, the two new system are more efficiency than the current system that an average time for a customer to wait in line is 8.5391 seconds. Therefore, these 2 new systems should be applied by considering other factors such as service area.





Robustness of the Three Control Charts to Non-normality Assumption

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The objective of this research is to compare the robustnesses of the three control charts – \bar{X} -control chart, the exponentially weighted moving average control chart (EWMA Control Chart) and the robust exponentially weighted moving average control chart (REWMA Control Chart) – for the case of non-normal distributions. Specifically, we used the gamma distribution with a scale parameter $\beta = 1$ and the shape parameter $\alpha = 0.5, 4$ and 100 to represent the case of skewed distributions and the standard normal distribution to represent the case of normality assumption. The studied factors consist of the sample sizes (n) which are $4, 6, 8, 10$ and 20 , and a subgroup size which is 25 . The criterion is examined robustness in term of an average run length (ARL_0). A simulation study was conducted by Monte Carlo technique with $1,000$ repetitions.

The results showed that the ARL_0 of EWMA Control Chart has the highest robustness to non-normality assumption whatever the levels of shape parameter α and sample size n . When the shape parameter α increases, the ARL_0 of \bar{X} -control chart tends to increase for all levels of sample size. Additionally, the ARL_0 of \bar{X} -control chart for the gamma distribution with $\alpha = 100$ seems to close that for the standard normal distribution whatever the values of sample size. Further, the efficiency of REWMA control chart is better than that of \bar{X} -control chart for both normal and non-normal distributions at all levels of sample size.

Keywords: Gamma Distribution, Control Chart, \bar{X} -Control Chart, Average Run Length





Forecasting the Water Volume in Wachiralongkorn Dam with Box-Jenkins and Winter's Methods

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The purpose of this article is to find the best model for forecasting the water volume in Wachiralongkorn dam between two methods which are Box-Jenkins and Winter's method. Data of sixty water volumes were collected from the dam at every 15th of a month and divided into two sets as follows. The first set consists of forty eight values of collected from October 2009 to September 2013 and the second is the set of twelve water volumes collected from October 2013 to September 2014.

The first data set was used to find an appropriate model from the two methods. After that twelve values of water volume from October 2013 to September 2014 were predicted. The accuracy of the two models were compared by using the mean square error (MSE) and mean absolute percentage error (MAPE). The model having the lowest MSE and MAPE would be the best.

From the analysis by Box - Jenkins method, an appropriate model for this data set is SARIMA(1,1,0)(0,1,1)₁₂ without a constant value given by

$$\hat{Y}_t = Y_{t-1} + 0.632(Y_{t-1} - Y_{t-2} - Y_{t-3} + Y_{t-4}) + Y_{t-2} - Y_{t-3} + \varepsilon_t$$

where \hat{Y}_t is forecast value of the water volume in the dam at time t, and

ε_t is forecast error at time t where $\varepsilon_t \sim \text{NID}(0, \sigma^2)$.

Considering another one method, Winter's method obtained a suitable model for this data set given by

$$\hat{Y}_t = \hat{Y}_n(L) = [5611.627 + (-63.6794)L]\hat{S}_{n+L-s} \dots\dots\dots(1)$$

where \hat{S}_{n+L-s} is the seasonality estimate of season $n + L - s$.

Comparison the accuracy of two models, the MSE and MAPE computed from Box-Jenkins method are 1,770,501.00 and 22.74%, respectively, and those from Winter's method are 410,892.20 and 11.27%, respectively. It is obvious that the model from Winter's method has lower values of MSE and MAPE than those from Box-Jenkins method. The conclusion is that the most accurate model for this data is the model from Winter's method as given in (1).





Comparison of Forecasting Techniques: A Case Study of Agricultural Export

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The objective of this research is to compare the efficiency of the method for create a forecasting model by using four techniques consists of simple exponential smoothing, double exponential smoothing, decomposition and Box-Jenkins method.

This study using three kinds of time series data consists of stationary time series and non-stationary time series. For non-stationary time series with trend data and with trend and seasonal data. Case of this study used the amount of monthly export of the agricultural products from January 2009 to August 2014, which are consist of the amount of exporting dried mushroom, nourishment made from flour and sugar. The result of this study to compare the efficiency of each method considers accuracy of forecasting by using mean square error (MSE) and mean absolute percentage error (MAPE).The best model is the lowest value of MSE and MAPE.

The results of each case study follows:

The amount of exporting dried mushroom is the stationary model, in this case we compare forecasting techniques which are the simple exponential smoothing method and the Box-Jenkins method, the best techniques is simple exponential smoothing method giving 1395.21 of MSE and 42.96 of MAPE.

For the amount of exporting of nourishment made from flour is the non-stationary model with trend, the double exponential smoothing method and Box-Jenkins method were compared, the best technique is the Box-Jenkins method giving 1.26 of MSE and 1.01 of MAPE.

And for the amount of exporting sugar is the non-stationary model with trend & seasonal, in this study, decomposition method and Box-Jenkins method were compared, the best technique is also the Box-Jenkins method giving 28.42 of MSE and 4.43 of MAPE.





Exercise Behavior in Undergraduate Students of Faculty of Science, Kasetsart University

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In the few years, healthy trend is very strong and important. Many people turn to focus on health care more but there are only small group when compared with the large group that neglected the health problems. This is the main reason lead to the disease. This research aims to study the exercise behavior in Undergraduate students of Faculty of Science, Kasetsart University. Questionnaires are used for data collection from the undergraduate students 345 samples. The factors consist of 3 categorical variables: Sex is categorized into 2 levels, Year into 4 levels, and Exercise into 5 levels. The analysis using loglinear model found that the estimated loglinear model is as follows:

$$\log m_{ijk} = \mu + u_i^{\text{sex}} + u_j^{\text{year}} + u_k^{\text{exercise}} + u_{ij}^{\text{sex, year}} + u_{ik}^{\text{year, exercise}}$$

This model provides an adequate fit to the data. There are significantly associated between two variables Year and Exercise at 0.05 significance level.

Keywords: Exercise behavior, Loglinear model, Odds ratio





Product Estimators of a Population Mean in Stratified Random Sampling

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The objective of this research is to propose new product estimators of a population mean in stratified random sampling. These estimators are applied from the estimators proposed by Upadhyaya and Singh (1999) and Kadilar and Cingi (2006), and based on Kadilar and cingi (2005). The efficiency of proposed estimators is compared with the traditional product estimator on the basis of theoretical mean square error (MSE) and percent relative efficiency. The research results show that the proposed estimators are more efficient than the traditional product estimator under some conditions. In addition, these theoretical results are supported by a numeric example.

Keywords: Mean square error, Product estimator, Stratified random sampling





A Comparison for Homogeneity of Variance Test

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The objective of this research is to compare the capability to control type I error and the power of the four Homogeneity of variance tests which include the Levene's test (L), O'Brien's test (OB), Overall-Woodward Modified Z-variance's test (OW) and T_3 's test. Both equal and unequal sample size of four groups of population are considered. The data is composed of normal distribution, chi-square distribution and t-distribution, with the specified significance level of 0.05. The power of the test is considered by using the ratio of variance 1.0 : 1.5 : 2.0 : 2.5. The data was simulated by using the Monte Carlo technique and replicated 1000 times with SAS 9.3. The results show that for the normal distribution, the T_3 's test shows the highest efficiency in controlling the type I error and the power of the test. For the chi-square distribution (df = 5), the OB's test and OW's test show the best capabilities to control the type I error, and the OW's test also produces the highest power of the test. For the chi-square distribution (df = 20), the OB's test shows the highest efficiency to control the type I error, and Levene's test produces the highest power of the test. For the t-distribution (df = 4), the Levene's test and the OB's test show the highest efficiency to control the type I error, and Levene's test produces the highest power of the test. Lastly, for the t-distribution (df = 10), OB's test produces the best results to control the type I error, and OW's test produces the highest power of the test. The results indicate that the power of the test is affected by both the distribution of the population and the sample size.

Keywords: Homogeneity of Variance Test, Type I error, Levene's test, O'Brien's test, Overall-Woodward Modified Z-variance's test, T_3 's test.





THE EFFICIENCY COMPARISONS OF MULTIPLE COMPARISONS ON ONE-WAY ANOVA WITH STATISTICAL PACKAGES

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This study aimed to compare the Multiple Comparisons performance on ANOVA of Statistical Packages to be as a guideline for choosing the right program to compare the Multiple Comparisons performance in several aspects such as consistency of analysis result, ease of use and the processing time.

The terms of consistency, the result shown that there are provide the corresponding analysis result. In terms of ease of use, SPSS program is the most user-friendly in both forms of menus and commands so it is an ideal for those who is the beginner and found the writing style of command in SPSS and SAS programs have a standard command on all method of multiple comparisons but R program found that in some way have to run the package more. Each package has a different command. In terms of the ease of reading result shown that the SAS program display the same character in every way so it is easy to read the results of the analysis. In terms of processing time, SAS program takes the least processing time of all programs and it's processing time is not depend on the size of data or group of data. If you want to analyze a large data, SAS is the most effective program of three programs. In various terms, we can conclude that SPSS program is available for beginners and SAS program is the least processing time.

Keywords: Program Comparison, Multiple Comparison, ANOVA, Statistic Package, SPSS, SAS, R





A Comparison of Stock Price Forecasting Using Statistical Methods and Fundamental Analysis: A Case Study of Tourism and Recreation Business Group.

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This research aims to analysis the fundamental analysis and to forecast about the stock price of tourism and recreation business group in the Stock Exchange of Thailand (SET). By using the fundamental analysis criteria, Price Per Earnings ratio (P/E ratio), Price Per Book Value ratio (P/BV ratio), Return On Assets (ROA) and Return On Equity (ROE). There are four forecasting methods used in this research including Box-Jenkins Method, Simple Exponential Smoothing (SES), Holt's Two-Parameter Method or Double Exponential Smoothing and Multiple Regression Analysis which had collected data since January 2007 to September 2014. In this research, we compared all four forecasting methods by using the analysis criteria from the value of the accuracy of the forecasting that are Mean Absolute Percentage Error (MAPE), Mean Square Error (MSE) and Tracking Signal (TS) to find the appropriate period of forecasting.

The result of fundamental analyzing showed that GRAND stock is the most interesting stock to invest because the P/E, P/BV are lower and ROA, ROE are higher than the other stocks in the group. From the data it showed had no seasonal, therefore we compared all four forecasting methods which include Box-Jenkins Method, SES, Holt's Two-Parameter Method and Multiple Regression Analysis. The value of MAPE of each method is 64.50428, 80.94800, 72.76910 and 71.76623 respectively and value of MSE is 3.594, 4.2309, 4.7325 and 4.653 respectively also. From the result above, it indicated that forecasting by Box-Jenkins Method give an accurate value than other methods by getting the appropriate beforehand forecasting period from TS ($\pm 2\hat{\sigma}_e$) of Box-Jenkins Method, the forecasting period shouldn't over five periods.





Yeast strain improvement to enhance lipase production

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Yeast lipase catalyze the hydrolysis of fat. These enzymes have potential applications in industry. Yeast strain improvement by mutation and protoplast fusion has importance to enhance the productivity of extracellular lipase from yeast. The objectives of this research were to isolate and screen for lipase producing yeasts. Thirty-five yeast isolates from four cafeterias in Kasetsart University were screened on *Tween 80 agar*. Twelve isolates exhibited lipase producing zone. Extracellular lipases activity from isolate L1-3 was assayed and the activity of 6.76 U/ml was observed when this yeast was grown in 50 ml of lipase production broth for 72 h at 30°C on rotary shaker at 170 rpm. Then, mutation and protoplast fusion were used to improve lipase production of the isolate L1-3. The mutant strain called L1-3EMS1 was obtained as a result of Ethyl Methane Sulfonate (EMS) induced mutation. This mutant showed 1.2 times of extracellular lipase activity when compared to that of the wild type strain. However, none of the UV induced mutants showed higher level of extracellular lipase production than the wild type. As a result of L1-3 self protoplast fusion, L1-3F2 fusant showed higher extracellular lipase activity than that of the wild type strain.

Keywords: lipase, induced mutation, protoplast fusion, yeast





Isolation and Screening of Potential Halotolerant Yeasts from Solar Salterns in Samut Songkhram, Thailand for Biotechnological Applications

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Solar salterns, located in tropical and subtropical areas worldwide, are artificial shallow ponds for the production of halite (NaCl) from seawater. To study a diversity of halotolerant yeasts in the solar saltern environment, we collected 40 soil samples from 4 different saltern ponds in a system, where a salinity increases in each stage, in Samut-Songkhram, Thailand and isolated the yeasts by using yeast extract-peptone-dextrose (YPD) agar supplemented with 3% sodium chloride, chloramphenicol and sodium propionate and incubated at 37°C and 40°C. A total of 12 isolates were obtained and they were subsequently identified by sequencing analysis of the D1/D2 domain of 26S rDNA gene with a universal primer set, NL1 (5'-CATATCAATAAGCGGAGGAAAAG-3') and NL4 (5'-GTCCGTGTTTCAAGACGG-3'). As a result, *Candida orthopsilosis* (1 isolate), *Candida parapsilosis* (2 isolates), *Candida tropicalis* (4 isolates), *Issatchenkia orientalis* (2 isolates), *Meyerozyma guilliermondii* (2 isolates) and yeast-like fungi (1 isolate) were obtained. The cell shape and budding type of isolated yeasts were mostly ellipsoidal and multilateral budding, respectively. Some isolates could form pseudohyphae. At 37°C, *Candida orthopsilosis* (CR1-1), *Candida parapsilosis* (DR2-1 and TR2-1) and *Candida tropicalis* (PR5-1, PT5-1, PR8-1 and PT8-1) were able to grow in YPD medium supplemented with 10% sodium chloride or 25% glycerol. All of yeasts isolated had ability to utilize xylose as a carbon source at both 30°C and 37°C, but only *Meyerozyma guilliermondii* (PR4-1 and PT4-1) had ability to utilize inulin as a carbon source. Two strains of *Issatchenkia orientalis* (PR1-1 and PT1-1) and four strains of *Candida tropicalis* (PR5-1, PT5-1, PR8-1 and PT8-1) could produce proteolytic enzyme and form lipid granules, respectively. The genus *Candida* was found the most in yeasts isolated. Taken together, our results demonstrated the abilities of yeasts isolated for further employing in biotechnological applications.





Capability of Actinomycetes to Inhibit Rice Pathogenic Fungi in Saline Condition

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Six actinomycetes from previous research, which were isolated from rice field, solarsalern soil and rhizosphere soil, were studied for their ability to grow on PDA medium pH 5 and pH 7 supplemented with NaCl concentrations of 0, 100, 200 and 300 mM. After incubation for 7 days, all isolates could grow well in both pH 5 and 7. The growth of these strains was decreased when NaCl concentrations was increased. Among these, isolate R8-39 on medium pH 5 could grow well with NaCl concentrations up to 300 mM. The ability of these strains to inhibit rice pathogenic fungi *Helminthosporiumoryzae* and *Fusariummoniliforme* were tested by dual culture technique in PDA pH 5 and 7, with NaCl concentrations of 0, 100, 200 and 300 mM. The result showed that all isolates have ability to inhibit the growth of 2 tested fungi on PDA pH 5 and 7 without NaCl. Isolate RF3-7 had the highest ability to inhibit *H. oryzae* and *F. moniliforme* at all tested conditions. Isolate RF3-7 was selected to test for its effect on the germination of rice seed at pH 5, with NaCl concentrations of 0, 100, and 200 mM on moist tissue paper. Data analysis by SPSS using *Duncan's* multiple range test showed that the NaCl concentrations of 0, 100, and 200 mM had effect to rice seed germination. The use of *H. oryzae* spore suspension and *H. oryzae* mixed with RF3-7 spore suspension significantly showed effect to rice seed germination when compare to seed treated with RF3-7 ($p \leq 0.05$). Seven days after seeding, rice seeds soaked with RF3-7 spore suspension had shorter stem but produced more secondary roots than control treatment.

Keywords: actinomycete, antifungal, *Fusariummoniliforme*, *Helminthosporiumoryzae*, rice, saline condition





Screening and Identification of Phytase - Producing Fungi

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Thirty-eight soil samples were screened for phytase-producing filamentous fungi. The soil samples were collected from Kasetsart University, agricultural land and around the trees in community areas and forests. Phytase Screening Medium supplemented with an antibiotic (Tetracycline) was used to isolate phytase-producing filamentous fungi. The antibiotic could inhibit the growth of bacteria but did not affect the growth of fungi. The phytase-producing fungi can degrade phytate which was used as an ingredient in the screening medium resulting in a clear zone formation around the colony. Fifty-five isolates which are different in colony appearance and can degrade phytate were selected and eleven isolates can degrade phytate most efficiently. The highest phytase-producing fungi were observed under microscope and identified.

Keywords: phytase, phytase-producing fungi, phytate





Antifungal properties of lactic acid bacteria isolated from foods

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Fungi are common spoilage organism of various foods such as bread, cereal, cheese, fruit and vegetables. The fungal growth may result in food spoilage and food poisoning due to its toxins. The economic losses for bakery industry due to fungal growth are quite enormously. Recently, lactic acid bacteria were widely exploited as biopreservative in meat and dairy products but not in bakery products. Therefore, the aim of this study was to isolate antifungal LAB and apply as a biopreservative in bread.

In this study, three fungi were isolated from spoiled bread by spread plate technique on Potato Dextrose Agar (PDA) and used as indicator strains for further study. All fungi were identified by macroscopic and microscopic characteristics such as pigmentation (surface and reverse), conidial characteristics (septation and color) and arrangement of conidia. The isolate M1 is classified as *Penicillium* sp. whereas isolates M2 and M3 were classified as *Aspergillus* sp. For lactic acid bacteria, a total of 180 colonies were isolated from various foods by spread plate technique on MRS supplemented with 0.5% calcium carbonate. Morphological and physiological characteristics were examined. All isolates were gram positive and catalase negative. Seventy five percent of LAB was cocci shape whereas rod shape accounted for only 25%. For sugar metabolism, 67% were homofermentative LAB and 37% belong to heterofermentative group. All LAB isolates were examined for antifungal properties against 3 indicator fungi mentioned above by direct spot and agar diffusion method. It was found that none of LAB can inhibit mycelial growth of all fungi tested. In addition, inhibition of spore germination will also be conducted. The potent isolate of LAB will be used as biopreservative in bread to replace the commercial chemical preservative.

Keywords: Antifungal, Lactic acid bacteria, bread





Study on Cuticle Degrading Enzymes Produced from Filamentous Fungi Grew after Flood

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An attractive alternative method to chemical pesticides is the microbial biocontrol agents. Several species of fungi are potent biocontrol agents of insect pests. Their mode of action for killing insect pests is primarily based on toxic protein and cuticle degrading enzymes such as proteinase, lipase and chitinase. To screen fungi for their potential abilities to control insect pests, nine isolates of filamentous fungi grew after flood were tested. Antagonistic activity and production of cuticle degrading enzymes were determined for screening of the promising fungal strains.

Metarhiziumanisopliae, widely used as biocontrol agent, was used as a reference strain. Antagonistic activity against bacteria revealed that five isolates such as *Paecilomycesvariotii*, *Aspergillussojae*, *A.oryzae*, *A. flavus* and *Penicillium* sp. were effective in restricting the bacterial growth. Maximum activities of proteinase, lipase and chitinase that *M.anisopliae* produced after 6 days were 6.7, 0.5 and 3.8 U/mL, respectively. The highest proteinase activity from *A. oryzae* and *A. sojae* were obtained after 2 days (13 U/mL). Moreover, *A. oryzae* exhibited 3 times higher activity of lipase than that of *M.anisopliae*. Therefore, fungal isolates revealed in this study might be a promising fungus for biological control.

Keyword: culticle-degrading enzyme, chitinase, lipase, proteinase, toxicity, fungi





Production monoclonal antibodies specific to *Escherichia coli* O157:H7

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E. coli O157:H7 is an enterohemorrhagic serotype of *Escherichia coli*. This serotype of bacteria is important food- and water-borne pathogen worldwide which cause non-bloody diarrhea, bloody diarrhea (hemorrhagic colitis), and hemolytic uremic syndrome (HUS) characterized by hemolytic anemia, thrombocytopenia and potentially fatal acute renal failure. *E. coli* O157:H7 express shiga-like toxins (Stx) which gained this ability due to infection with a prophage containing the structural coding for the toxin. Rapid and specific test for detection of *E. coli* O157:H7 is important for food safety which require specific monoclonal antibody as probe. Production and characterization of monoclonal antibodies specific to *E. coli* O157:H7 were performed. *E. coli* O157:H7 which cannot ferment sorbitol was cultured in nutrient agar and used as whole-bacterium antigen suspension for immunization of Balb/c mice. Mice were immunized subcutaneously and intraperitoneally with bacterial antigen mixed with Freund's adjuvant four time at two weeks interval. Sera from immunized mice were use as polyclonal antibody for *E. coli* O157:H7 for set up of indirect ELISA test for screening of monoclonal antibody production. Sonicated *E. coli* O157:H7 was used as antigen for coating of ELISA plate.

Last immunization of mice were done 3 days before cell fusion by intraperitoneally injection of 0.1 ml antigen suspension of *E. coli* O157:H7 without adjuvant. Spleen cells of immunized mice were fused with myeloma cells by using polyethylene glycol (PEG) before plating into 96 wells cell culture plates containing DMEM-HAT medium as selective medium for hybridoma cells. After hybridoma cells grew as big clone, cell culture fluid from wells were tested for monoclonal antibody production by ELISA test. Hybridoma cells which produced monoclonal antibody were cloned by limiting dilution and expanded for large cell number for production of monoclonal antibody and characterization of specificity further.

Keywords: Monoclonal antibodies, *Escherichia coli* O157:H7, indirect ELISA





Screening of urease and high calcite production bacteria from soil and limestone in Saraburi province for soil quality improvement

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Improvement of land subsidence and cracking concrete problem by the micro-organisms that have the potential to precipitate calcium carbonate for safety environment were previously studied by many researchers. Calcium carbonate from bacteria might be used instep of application asbio-sealant to seal cracks or holds in the buildings or monuments. This study was focused on screening of the bacteria that can produce enzyme urease and high calcium carbonate precipitation from soil and limestone in Saraburi province which is the major source of limestone and cement production in Thailand. Two hundred sixty three bacterial strains were isolated from 15 samples of soil and limestone by growing on NB medium with urea 2% and spreading on NA medium and incubating on aerobic and anaerobic condition. Different colonies were picked and primary screened of ability to produce the enzyme urease with Christensen urea agar medium. Thirty six strains were obtained and secondary screened for highest urease producing isolates with urea broth medium which containing of high buffer. We found that 26 from 36 strains gave positive result on urea broth medium. These strains were comparative tested on quantitative production of calcium carbonate by inoculation in NB supplemented with 2% urea, incubated for 24 hrs., centrifuged and then added 0.4 M CaCl_2 to the supernatant. Reaction of excess of Ca^{2+} with CO_3 from supernatant caused CaCO_3 precipitation. This was called Microbially Induced Calcium carbonate Precipitation (MICP). Quantity of CaCO_3 from each strain was determined by EDTA titration method of APHA (1980). The results showed that 12 bacterial strains could produce CaCO_3 as highest yield up to 20-30 g/l. All of these strains were gram positive rod shape endospore forming bacteria that could produce catalase. Almost of them had swollen spherical terminal endospore and were aerobic bacteria. By Conventional studies following the methods described by Gordon (1989), they were closely classified as *Bacillus sphaericus*.

Keyword: *Bacillus sphaericus*, ureolytic bacteria, urease, calcium carbonate precipitation





Selection of oleaginous yeast for lipid production from lignocellulolytichydrolysate

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This research aims to select the oleaginous yeast accumulate high lipid when cultivated in hydrolysate of sugarcane top, a by product of agricultural waste. The sugarcane top hydrolysate was prepared by treated using 2% dilute sulfuric acid (1g sugarcane top per 10 ml of 2% dilute sulfuric acid) in an autoclave at 121°C for 60 min. The hydrolysate contained 33.97 g/l reducing sugar composed of 11.20 g/l glucose, 21.13 g/l xylose and 0.60 g/l arabinose. Detoxification of degradation products, such as acetic acid, fufural and hydroxymethylfurfural that may effect growth of microorganisms in sugarcane top hydrolysate was carried out by $\text{Ca}(\text{OH})_2$ and heat. In the primary screening 18 yeast strains, which were reported to accumulate high lipid, were determined for their lipid accumulation when cultured in nitrogen-limited broth containing 7% glucose, xylose or mixture of glucose and xylose on a rotary shaker at 150 rpm and 28°C for 7 days. The result revealed that eight strains could accumulate lipid in the range of 17–41% of dry biomass, so that they were selected for further screening. In the secondary screening, the selected yeast strains were cultivated in hydrolysate containing 1.2% glucose and 2.1% xylose by shaking flask cultivation at 150 rpm and 28°C for 10 days and lipid was analysed. The result showed that four oleaginous yeast strains including *Rhodospiridium fluviale* (DMKU-SP314 and DMKU-RK253) and *Rhodospiridium toruloides* (DMKU-RE124 and DMKU-RE16) showed low growth and lipid production. *R. toruloides* DMKU-RE16 produced the highest lipid of only 0.33 g/l when dry biomass was 9.33 g/l, resulted in the highest lipid content of only 3.22% of cell dry biomass.





Screening and study on factors influenced in phenol biodegradation by some halo tolerant Gram positive bacteria isolated from soil

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Screening for Gram-positive group, salt tolerant species capable of degrading phenol was carried out. The results revealed 8 out of 24 isolates can grow and produce slightly acid on the mineral salt medium (MSM) with phenol concentration of 500 mg per liter by tracking the growth for 5 days. Then their growths on medium with phenol concentrations ranging from 500-2000 mg per liter were tested. -Three selected isolates namely P6-18, C89 and BT4 were found to be able to grow and produce slightly acid on MSM containing phenol up to 2000 mg per liter. Identification by 16S rRNA gene analysis indicated that P6-18 is the bacterium *Bacillus licheniformis* whereas C89 and BT4 are the bacteria *Corynebacterium ammoniagenes*. The 3 selected isolates grew well on MSM pH 8 with phenol and yeast extract while produce more acid on MSM with phenol and sugar (mannitol, sucrose or glucose) To further elucidate their abilities on phenol degradation, growth and factors involved in phenol degradation of the 3 selected isolates will be clarified by culturing in liquid MSM pH 8 with phenol concentration 2000 mg per liter as the sole carbon source or with co-carbon source. Following the growth by determination of turbidity at a wavelength of 600 nm and measuring the amount of the remaining phenol by HPLC analysis.

Keywords: phenol, biodegradation, salt tolerant Gram positive bacteria





The role of IGF1R gene in chronic hepatitis B virus infection

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Hepatitis B virus (HBV) infection is a public health problem worldwide. Approximately 400 million people have chronic HBV infection and about 1 million die annually from HBV-related liver disease. An insulin-like growth factor 1 receptor (IGF1R) belongs to tyrosine kinase receptors class. It is activated by binding to insulin-like growth factor 1 (IGF1) and IGF2. IGF1R is involved in several cancers including HBV-related hepatocellular carcinoma (HCC) studied in Chinese. However, the association between genetic variants in IGF1R and the development of chronic HBV infection has not been investigated among Thai. The objective of this research is to explore the association of IGF1R gene polymorphism with chronic HBV infection. A total of 399 individuals including 122 chronic HBV without HCC patients, 70 chronic HBV with HCC, 72 recovered individuals and 135 healthy controls were recruited in this study. A single nucleotide polymorphism of IGF1R gene (rs3743521) was analyzed by polymerase chain reaction-restriction fragment length polymorphism method. In this study, we found that T allele of rs3743521 significantly increased risk of HBV-related HCC as compared to normal controls and patients without HCC [OR(95% CI) = 1.81 (1.17-2.79), $P=0.005$; OR(95% CI) = 1.59 (1.02-2.47), $P=0.031$, respectively]. The effect of T allele was similar to that of an autosomal dominance in the presence of TT and CT genotype compared with CC genotype [OR (95% CI)=2.11 (1.07–4.19), $P=0.019$]. These results suggest that the IGF1R rs3743521 T allele is associated with susceptibility to HBV-related HCC.





Study of Cellulase and Pectinase Producing Bacteria Isolated from the Guts of Termites

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Termites (order Isoptera) are important terrestrial insects in forest ecosystems. They are world champions at digesting cellulose-based materials by gut microorganisms. In this study, bacteria isolated from the guts of termites were tested their abilities to produced cellulolytic and pectinolytic enzymes. Moreover, the optimum conditions (pH and temperature) for producing the enzymes were tested. A total of 105 different isolates were purified and characterized from the guts of 11 termite species that collected from Sakaerat Environmental Research Station, Wang Nam Kiew, Nakhon Ratchasima, Thailand. In this study, all isolates were tested their ability to degrade carboxymethyl cellulose (CMC) and pectin on solid media with different pH (5, 7, 9, 12) and temperatures (28, 35, 42°C). The results showed that, many isolates showed the ability and high activity to produce cellulase and pectinase at the extreme pH and temperature. The isolates were extracted their genomic DNA. The 16S rRNA genes were amplified by polymerase chain reaction (PCR) and identified by DNA sequencing and phylogenetic tree. It said that the bacteria in termitegut are diverse and valuable to produce the extreme enzymes. The isolates and their enzymes will be useful for application in many biotechnological industries. The cellulolytic bacteria and their cellulase can be applied for bioethanol production from cellulose materials. The activity of pectinase at low pH is useful for production of acidic fruit juices.

Keywords: bacteria, termite, cellulase, pectinase





Endophytic actinomycetes isolated from root of *Pterocarpus indicus* Wild and their ability to produce siderophore and solubilize phosphate

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Thirty-two actinomycetes were isolated from roots and root nodules of *Pterocarpus indicus* Wild., collected from Kasetsart University, Bangkok Campus, using starch casein (SC) agar medium. Colour of spore mass, substrate mycelium, soluble pigments and their morphological characteristics of these isolates on ISP medium 3 were studied. Determination of diaminopimelic acid isomer in whole-cell hydrolysates revealed that twenty-three isolates contained LL-isomer of DAP, which belonged to the streptomycetes group. Nine isolates contained *meso*-isomer were assigned into the group of non-streptomycetes. All isolates were examined for siderophore production on Chrome Azurol S (CAS) medium. The result showed that thirty isolates could produce siderophore and isolates PMS1 and PLB1 showed the highest activity. Their ability to solubilize phosphate on Pikovskaya's (PVK) agar medium showed that twenty-four isolates were able to solubilize phosphate and isolate PLB1 had the highest phosphate solubilization activity. The inhibitory activity against *Xanthomonas campestris* pv. *glycines* was tested by agar overlay method. Seven isolates were able to inhibit the test organism. Interestingly, strain PMS1 showed the highest activity in siderophore production, with ability to solubilize phosphate and activity to inhibit *Xanthomonas campestris* pv. *glycines*.

Keywords: actinomycete, siderophore, phosphate solubilize, *Xanthomonas campestris* pv. *sa glycines*





Amylolytic and antagonistic properties of Lactic acid bacteria isolated from fermented rice noodle (Khanom-jeen)

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Khanom-jeen (fermented rice noodle) is a Thai traditional fermented product and usually sold as a ready to eat food. The shelf life of Khanom-jeen was quite short unless chemical preservative was added. Therefore, this study aims to determine the microbiological quality of Khanom-jeen sold in local market and screened for LAB with amylolytic and antagonistic activity. Twenty samples of Khanom-jeen were determined for total bacterial count on TSA agar and coliform and *E. coli* counts on EMB agar. The total bacterial counts were ranged between 2.5×10^3 - 1.4×10^8 CFU/g and the amounts were increased to 1×10^5 - 4.6×10^9 CFU/g after being kept at room temperature for 5-7 days. Coliform and *E. coli* were detected in all samples indicating a poor hygienic production or post-contamination during distribution. However, LAB counts was also noted on MRS agar in the range of 2×10^2 - 5×10^7 CFU/g. In this study, 184 isolates of LAB were randomly picked for amylolytic activity. Only 38 isolates (21.1%) gave a positive clear zone on Modified MRS agar with 1% soluble starch and incubated at 37°C for 24-72 hrs. Among these, only 4 isolates (2.2%) possess a strong amylolytic activity with a clear zone greater than 2-3 cm. Furthermore, all LAB isolates were also tested for antibacterial activity against both gram positive and gram negative bacteria by agar spot test and spot on lawn technique. The potent strain will be selected to be used as a starter culture for rice noodle fermentation and to extend the shelf life of product and decreased the risk of foodborne pathogens.

Keywords: Khanom-jeen, Amylolytic Lactic acid bacteria, Antimicrobial activity.





Characterization and Dephytinization of phytase from *Pichia kudriavzevii* WB17-1

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Phytase catalyze the hydrolysis of phytic acid into inorganic phosphate. This research was aimed to characterize phytase from *Pichia kudriavzevii* WB17-1. In addition, dephytinization of some feed starting materials was investigated using crude phytase from this yeast. Cell bound phytase was produced from *P. kudriavzevii* WB17-1 and phytase activity of 273 mU/ml was obtained after cultivation at 37°C for 5 days. The enzyme was characterized for its optimum pH and temperature, pH and temperature stabilities and metal ions preference. The results showed that optimum pH and optimum temperature of this enzyme were 4.0 and 55°C, respectively. The cell bound phytase of *P. kudriavzevii* WB17-1 was stable at the pH ranged from 3.0 to 6.0 and 20% of the phytase activity remained after 1 hr incubation at pH 9.0. After 1 h incubation at 45°C, 40% of the phytase activity was observed. The cell bound phytase activity was stimulated by Mg^{2+} , Ca^{2+} and EDTA. On the other hand, the phytase activity was strongly inhibited by Fe^{2+} and Cd^{2+} . Dephytinization of various feed substrates (corn, samp, paddy, soy pulp, broken milled rice, chaff, brown rice, rice bran and commercial feed) was compared between crude enzyme (a mixture of intracellular content obtained after cell breakage and cell debris) and cell bound phytase treatment after 30-180 min incubation. Results showed that crude enzyme from *P. kudriavzevii* WB17-1 was more efficient than the cell bound part, in particular, dephytinization of corn and paddy. Dephytinization of soy pulp, samp, broken milled rice, chaff, brown rice, rice bran and commercial feed by using crude enzyme showed 1-5 times more phosphate released compared to control condition that untreated with the enzyme. When the cell bound enzyme was used, 1-4 times more phosphate was released compared to control condition. The results of characterization and dephytinization of *P. kudriavzevii* WB17-1 phytase indicated a potency of this enzyme in feed industry.

Keywords: phytase, characterization, dephytinization





Cultivation of Green Microalgal *Chlorella* sp. for Lipid Production using CO₂ from Ethanol Fermentation by Yeast

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Microbial lipid produced by oleaginous microorganisms has been suggested as a potential feed stock for biodiesel production due to their similar fatty acids composition to that of vegetable oils. Utilization of carbon dioxide which is the by-product from various sources is one of the alternative choices for cultivation of microalgae. Microalgae can fix carbon dioxide as a carbon source for growth. *Chlorella* sp. is a unicellular green microalga of biotechnological interest that accumulates lipids under phototrophic and nitrogen-limited conditions. The objective of this research is to cultivate *Chlorella* sp. Using carbon dioxide from ethanol fermentation by yeast. The photoautotrophic culture of *Chlorella* sp. DMKU5202 in 150 milliliters of reduce nitrogen source NSIII medium for 7 days. In order to enhance lipid production by microalgae, carbon dioxide obtained from semi-continuous fermentation of ethanol production from molasses using *Saccharomyces cerevisiae* SC90 in 8 liters fermentor at 30 °C. The concentration of CO₂ in the air was varies at 3%, 5%, and 10% v/v. Light was provided continuously and culture temperature was maintained at 25°C. The results showed that CO₂ was released continuously from ethanol fermentation in molasses medium containing 22% w/v fermentable sugars for 48 hours. In this study, the optimal CO₂ concentration for growth and lipid production was 5% v/v CO₂. At this condition the highest lipid yield was 11.118 g/L and 0.589 g/L of biomass. These results suggested the simple culture strategy by photoautotrophic batch cultures of *Chlorella* sp. using waste CO₂ for lipid production together with nitrogen-limited medium has a possibility and may be suitable for biodiesel production.





Isolation of petroleum hydrocarbon degrading yeasts from contaminated area to promote bioremediation process in nature

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The problem of contamination of petroleum hydrocarbon compounds is considered to be one of the major issues that impact on the environment. Therefore, finding microbes and bring for using in bioremediation process is rather interesting. In this study, we focused on yeasts. Ten water and ten soil samples from a contaminated area were collected and total yeasts were isolated using yeast extract malt extract (YM) medium. Twenty-seven yeast isolates were obtained and subsequently identified by amplified and sequencing the D1/D2 domain of 26S rDNA gene with a universal primer set, NL1 (5'-CATATCAATAAGCGGAGGAAAAG-3') and NL4 (5'-GTCCGTGTTTCAAGACGG-3'). As a result, the yeasts isolated were *Candida tropicalis* (17 isolates), *Pichia kudriavzevii* (5 isolates), *Candida rugosa* (4 isolates) and *Candida orthopsilosis* (1 isolates). The cell morphology of yeasts isolated was mostly globose. All of isolated yeasts were tested for their ability to grow under osmotic stress conditions. We found two candidates, S8-1 (*Candida orthopsilosis*) and W1-1 (*Pichia kudriavzevii*), which can grow on YM medium supplemented with glycerol up to 37% (v/v) at 40°C. All of isolated yeasts were tested for hexane degradation catalyzed by hexane hydroxylase in a basal medium containing 0.067% (w/v) yeast nitrogen base with ammonium sulfate and n-hexane ranging from 0.1-0.5% (v/v). Our result revealed that three yeast candidates including S6-3 (*Candida rugosa*), S8-3 (*Candida rugosa*) and S10-1 (*Pichia kudriavzevii*) could grow up by forming a colony in 0.1% hexane agar plate at 25°C. Moreover, the activity of catechol dioxygenase to degrade 2-methoxyphenol (aromatic hydrocarbon) is being investigated. Finally, some of the yeasts isolated may be useful for bioremediation process in the petroleum hydrocarbon contaminated area.





Antimicrobial activity of carbon-based materials

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The three types of nanoparticles were synthesized from carbon black (CB) with a different approach. Functional carbon black (F-CB), graphene oxide carbon black (GO-CB) and reduce graphene oxide carbon black (rGO-CB) were different ratio of carbon to oxygen and different molecular structures. The antimicrobial activity of these nanoparticles was investigated against nine microorganisms. Four bacterial species were *Escherichia coli* ATCC8739, *Staphylococcus aureus* ATCC6538, *Bacillus cereus* BCC6386 and *Salmonella Typhimurium*. One yeast species was *Candida albicans* TISTR5779 and three fungal species were *Aspergillusniger*, *Aspergillusoryzae* and *Fusariumoxysporum*. GO-CB at a concentration of 1,400 and 1,000 ppm inhibited the growth of *E.coli* ATCC8739 and *S. Typhimurium* after incubation 45 and 30 minutes, respectively. Characteristics of these bacterial cells were observed by Scanning Electron Microscope (SEM). The images showed that the cell wall of bacterial cells was damaged. However, the antimicrobial activity of nanoparticles was not inhibited yeast and fungal cells.

Keywords: antimicrobial activity, carbon black





Hydrophobin Extraction and Its Application for Leather Surface Coating

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Hydrophobins are small surface active proteins about 100 amino acids uniquely found in filamentous fungi and mushrooms. They found on surface hyphae, allowing them growing into air. Hydrophobin can convert a hydrophobic surface to hydrophilic and vice versa, which is involved in self-cleaning of surface. Leather is a produce from rawhide, by-product of livestock, giving value-added to raw material. Leather is a durable and flexible material used for various purposes including clothing. However, it is stained and dirty easily and difficult to clean. The objectives of this study were to extract hydrophobin from Phoenix mushroom (*Pleurotus pulmonarius*) and apply for coating on leather for surface modification. Colony surface of Phoenix mushroom growing on PDA showed considerably high water contact angle ($143.1^\circ \pm 2.4$) value, indicating its high surface hydrophobicity. Hydrophobin was extracted from Phoenix mushroom by ground in liquid nitrogen, followed by trifluoroacetic acid (TFA) extraction. Hydrophobin was dissolved in 60% ethanol. Untreated cow leather surface showed the WCA value of $91.1^\circ \pm 4.0$, indicating that cow leather surface used was hydrophobic. When coating hydrophobin solution on leather surface, its WCA value was reduced to $31.9^\circ \pm 7.5$ comparable to the use of Waxy, commercial polishing chemical, which reduced the WCA values to $42.1^\circ \pm 9.2$. Bovine serum albumin (BSA) was not able to reduce the hydrophobicity of leather surface as hydrophobin and waxy were. Interestingly, hydrophobin coated on leather surface tolerated to 1% hot SDS (sodium dodecyl sulfate) treatment, whereas Waxy did not. Therefore, hydrophobin was shown to be a good candidate for modifying the leather surface property.

Keywords: Hydrophobins, Surface coating, Leather, *Pleurotus pulmonarius*





Effect of Ethanol and Sugar Concentration on Growth and Ethanol Production at High Temperature of Thermotolerant Yeasts

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This research aimed to study the effect of ethanol and glucose concentrations on growth and ethanol production at high temperature of thermotolerant yeasts. Seven yeast strains including five strains of *Saccharomyces cerevisiae* i.e. M30, Sc90, TJ1, TJ3 and S087, two strains of *Kluyveromyces marxianus* i.e. DMKU3-1042 and KU-KS07, which can produce ethanol at high temperature, were used in this study. In order to obtain optimal temperature for growth for further study they were tested by culture on solid medium at 15-40°C. The result showed that all strains grew well at 37°C and the three strains i.e. DMKU3-1042, KU-KS07 and S087 grew at 40°C. Growth on solid medium containing 6-16 % (v/v) ethanol at 37°C showed that all strains grew on solid medium containing 6% (v/v) ethanol, five strains grew on solid medium containing 8% (v/v) ethanol and three strains i.e. M30, TJ3 and S087 grew on solid medium containing 10% (v/v) ethanol. None of the strains grew on solid medium containing 12, 14 and 16 % (v/v) ethanol. Growth on solid medium that contained 2-30% glucose at 35-40°C were determined and the result revealed that all strains still showed good growth on solid medium containing 30% glucose at 37°C. Ethanol production by these seven strains at 37°C in YPD broth containing 20-40% glucose were determined. Strain S087 produced the highest ethanol in 25-40% glucose and the highest ethanol of 12.71% (w/v) was obtained by fermentation in 40% glucose. The strain TJ3 produced the highest ethanol, 8.67 % (w/v), in 20% glucose. Because of the concentration of ethanol and sugar affect the growth of yeasts so we tried to increase the resistance ethanol and sugar of strain S087 by training. The strain S087 was repeated transferring to medium with increasing of ethanol or glucose concentrations.





Study of Environmental Factors on Phenanthrene and Phenol Biodegradation by Isolated Phenanthrene Degrading Bacterium

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Polycyclic aromatic hydrocarbons (PAHs) are considered as environmental pollutants. PAHs contain two or more fused aromatic rings. PAHs are known for their carcinogenic and mutagenic properties. Phenol, known as carboic acid, is an aromatic compound consisting of a phenyl group and hydroxyl group bound together. Phenol and its vapors are corrosive to the eyes, the skin, and the respiratory tract. Repeated or prolonged skin contact with phenol can cause dermatitis, or even second and third-degree burns. Using the phenanthrene enrichment cultivation method, we succeeded in screening bacterial strains with varied capability of phenanthrene utilization as a sole carbon source. Among isolated strains, one phenanthrene-degrading bacterium, *Pseudomonas sp.* CH3, was identified and examined for its potential to degrade phenanthrene. The aim of this work was to study the effect of environment factors, such as shaking speed, temperature, pH and initial phenanthrene concentration, on phenanthrene degradation. The strain CH3 was examined phenanthrene degradation at the initial concentration of 100 ppm for 6 days of incubation. *Pseudomonas sp.* CH3 was able to degrade phenanthrene at shaking speed from 0 to 180 rpm. The 97% of phenanthrene was degraded at the shaking speed of 180 rpm after 6 days of incubation. At room temperature ($30 \pm 2^\circ\text{C}$) and 35°C , the strain CH3 degraded up to 100% and 96% of phenanthrene after 6 days of incubation. However, at 40°C , only 37% of phenanthrene was degraded. The optimum pH for phenanthrene degradation of strain CH3 was found to be at 7. At other pH, CH3 growth seemed to be inhibited. Interestingly, the strain CH3 was able to degraded phenanthrene at initial concentrations in the range of 100 to 400 ppm. At the initial concentration of 200 ppm, 176 ppm of phenanthrene was degraded while at initial phenanthrene concentration of 400 ppm, 298 ppm of phenanthrene was degraded during 6 days of incubation. This result suggested that the strain CH3 was able to acclimatize to the high phenanthrene concentration up to 400 ppm. Additionally, *Pseudomonas sp.* CH3 showed a utilization of phenol in phenol containing media.

Keywords: PAHs, Phenanthrene, Phenol, Biodegradation, Environment factors





Mushrooms extract and their antimicrobial efficiency test

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The effect of crude extract from commercial mushrooms, including *Pleurotus ostreatus*, *Lentinus squarrosulus*, *Volvariella volvacea*, *Boletus* sp., *Pleurotus cystidiosus*, *Auricularia auricular*, *Ganoderma lucidum* and unknown were tested for their ability to inhibit the growth of plant pathogenic fungi and three common bacterial strains. Each mushroom was extracted by four different solvents; 95% ethanol, acetone, hexane and distilled water. The mushroom extracts were kept at 4 °C and tested for their antifungal (to *Curvularia lunata*, *Fusarium oxysporum*, *Pythium* sp. and *Sclerotium* sp.) and antibacterial activity (to *Bacillus cereus*, *Escherichia coli* and *Staphylococcus aureus*) by using the dual culture and disc agar diffusion methods, respectively. The results showed that all the mushroom extracts could not inhibit the fungal growth. However, the mushroom extract of *Ganoderma lucidum*, *Boletus* sp. and unknown which were extracted by 95% ethanol and *Pleurotus cystidiosus* which was extracted by hexane could inhibit the growth of *Bacillus cereus*. These four mushroom extracts were tested for their stability every month for five months. The results showed that the mushroom extracts from *Ganoderma lucidum*, *Boletus* sp. and *Pleurotus cystidiosus* retained the inhibitory activity after five months. The stability of four mushroom extracts at various temperatures were tested by putting the extract at 60°C, 100°C and room temperature for 30 minutes and tested. The results showed that the mushroom extracts from *Ganoderma lucidum*, *Boletus* sp. and *Pleurotus cystidiosus* retained the inhibitory activity at all temperatures tested. The minimum inhibitory concentration (MIC) values of the extracts from *Ganoderma lucidum*, *Boletus* sp. and unknown to the growth of *Bacillus cereus* were 4.6875, 150 and 300 mg/ml, respectively (*Pleurotus cystidiosus* not determined). The results showed that the crude extracts from *Ganoderma lucidum*, *Boletus* sp., unknown and *Pleurotus cystidiosus* could inhibit the growth of some bacteria which have potential to be utilized in the future.





Association study of *IRGM* gene with chronic hepatitis B virus infection

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Chronic Hepatitis B (CHB) is a serious disease caused by the hepatitis B virus (HBV). Chronic HBV infection can lead to liver cirrhosis and hepatocellular carcinoma (HCC). Immunity-related GTPase family M (*IRGM*) is a gene encoding protein that regulates autophagy formation in response to intracellular pathogens by destroying pathogens within the cytosol. In this study, we investigated the association of *IRGM* gene with chronic HBV infection in Thai population. We studied a single nucleotide polymorphism (SNP) in the *IRGM* gene (rs13361189 C/T). This SNP was examined in 425 subjects including 90 CHB with HCC patients, 119 CHB without HCC, 86 individuals with self-limited HBV infection and 130 healthy controls, by polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) method. Our results revealed significant risk of TT genotype of *IRGM* gene rs13361189 associated with CHB without HCC as compared to healthy controls [odds ratio (OR) (95% confidence interval (CI) = 1.80 (1.05-3.08), $P=0.023$] as well as total CHB (CHB and HCC) compared with healthy controls [OR (95% CI) = 1.77 (1.10-2.86), $P=0.012$]. These results suggest that the *IRGM* polymorphism might involve in the susceptibility to chronic HBV infection.

Keywords: *IRGM* gene, Hepatitis B virus, Chronic Hepatitis B, SNP, PCR-RFLP





Studies on Lipase Production under Various Salinity Conditions by Marine Bacteria Isolated from Mangrove Forest in Lam Son National Park, Ranong

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Lipase (EC 3.1.1.3) belong to a group of enzymes whose biological function is to catalyze the hydrolysis of triacylglycerols to diacylglycerols, monoacylglycerols, free fatty acids (FFA) and glycerol. In this research, we aimed to study on lipase production under various salinity conditions by marine bacteria isolated from mangrove forest in Lam Son National Park, Ranong. All isolates were preliminary screened for lipase activity by observing a colonies surrounding opaque zone or white precipitate on tween 80 agar that were incubated at room temperature for 48h. The result showed that Six isolates have high activity index under various NaCl concentrations (0, 0.5, 1.0, 1.5 and 2.0%). The culture supernatant of six isolates were further determined lipase activity using a colormetric assay at 410 nm. With p-nitrophenylpalmitate (p-NPP) as a substrate. The highest lipase activity was obtained from *Bacillus* sp. D1-SW-3 that were grown in lipase producing medium at room temperature for 48h.

Keywords: Lipase activity, Mangrove Forest, Marine bacteria, p-nitrophenylpalmitate (p-NPP)





Epiphytic yeasts from mushrooms, and their ability to enhance mushrooms growth

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Epiphytic yeasts are microorganism that live naturally with mushrooms. These epiphytic yeasts are the source of nitrogen which might suitable for mushroom growth. The objective of this study is to isolate the epiphytic yeasts and study their ability to enhance mushrooms growth. Three epiphytic yeasts strains; E2, E6.3 and E13 were co-cultivated with three strains of commercial mushrooms; *Pleurotusostratus*, *Pleurotuspulmonarius* and *Pleurotusflabellatus*. The mushrooms were cultivated on para rubber substrate and 2 treatments were performed. First, the epiphytic yeasts suspension was added on the substrate simultaneously with mushroom cultures and second, after the mushrooms mycelium were fully grown on the substrate. The mushrooms yield was measured and compared with control. The result showed that the first treatment provided higher mushrooms yield than the second treatment. *Pleurotusostratus* when co-cultivated with the epiphytic yeasts strainE13 produced the highest mushroom yield (364.52 g) when compared with control. *Pleurotuspulmonarius* when co-cultivated with the epiphytic yeasts strainE2 produced the highest mushroom yield (203.66 g) when compared with control. *Pleurotusflabellatus* when co-cultivated with the epiphytic yeasts strainE6.3 produced the highest mushroom yield (227.07 g) when compared with control. This result indicated that the epiphytic yeasts strainE13, E2 and E6.3 might be able to use for co-cultivated with *Pleurotusostratus*, *Pleurotuspulmonarius* and *Pleurotusflabellatus*, respectively.





Study on Antagonistic Effect and Mechanisms against Plant Pathogenic Fungi of Yeasts From Vetiver Rhizosphere Soil *In Vitro*

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This research aims to study antagonistic effect and mechanisms against plant pathogenic fungi of yeasts isolated from vetiver rhizosphere soil. Forty nine yeast strains of nine species which were isolated from vetiver rhizosphere soil, were determined for their antagonistic effect against rice pathogenic fungi *viz. Fusarium moniliforme* and *Rhizoctonia solani*, corn pathogenic fungi *viz. Bipolarismaydis*, *Bipolariszeicola*, *Exserohilumturcicum* and *Fusariummoniliforme*, and sugarcane pathogenic fungi *viz. Colletotrichumfalcatum* and *Fusarium moniliforme* by using dual-culture technique on solid medium in petri dish. The result showed that for rice diseases 42 yeast strains inhibited growth of *F.moniliforme* (bakanae disease) and 24 yeast strains inhibited growth of *R. solani* (sheath blight disease). All 49 yeast strains showed low antagonistic activities against two corn pathogenic fungi *viz.B.maydis* (southern leaf blight disease) and *E.turcicum* (northern leaf blight disease). Twenty four yeast strains inhibited *B.zeicola* (northern leaf spot). Forty six yeast strains inhibited growth of *F. moniliforme* (stem rot disease of corn). The two pathogenic fungi causing sugarcane red rot wilt disease namely *C.falcatum* and *F. moniliforme* were inhibited by 33 and 24 yeast strains, respectively. From the result of antagonistic activity testing seven yeast strains showing high antagonistic effect against plant pathogenic fungi were selected and determined for their capacity to produce antifungal volatile compound. The result revealed that two strains each of *Candida tropicalis* and *Meyerozymacaribbica* produced volatile compounds that inhibited growth of three corn pathogenic fungiviz.*B. maydis*, *E. turcicum* and *F. moniliforme*. Three strains of *Torulasporaglobosa* produced volatile compounds that inhibited two rice pathogenic fungi, three corn pathogenic fungi viz.*B. maydis*, *E. turcicum* and *F. moniliforme* and one sugarcane pathogenic fungusviz.*F. moniliforme*. Changing of mycelium morphology of four plant pathogenic fungiviz.*B. maydis*, *C. falcatum*, *F.moliniforme* (corn) and *F. Moliniforme* (sugarcane) by the seven antagonistic yeasts were investigated on solid medium. The result revealed that there were some changes of myceliummorphology of the four plant pathogenic fungi comparing with their mycelium when grew without antagonistic yeast.





Studies on Protease Production under Various Salinity Conditions by Marine Bacteria Isolated from Mangrove Forest in Lam Son National Park, Ranong

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Microbial proteases constitute the largest share of the enzyme market especially industrial enzymes which are required for a diverse range of catalytic activity and stability. Mangrove forest ecology is the source of these enzymes due to its physical fluctuations such as pH, temperature and salinity from waves and tides. Production and some characterizations of protease enzymes under various salinity conditions from marine bacteria isolated from mangrove forest at Ranong Mangrove Forest Research Center were investigated. Protease activity index was determined by drop inoculation method on skimmed milk agar and measuring the ratio of clear zone and colony size diameter. Eleven isolates showed high activity index with various NaCl concentrations from 0.0% -2.0%. Cell-free extract of isolate D1DW13 was consequently assayed to optimize for suitable NaCl concentration and production time with colorimetric method by using casein as substrate. The highest activity was from the culture with 0.5% NaCl concentration harvested at 72 hour. Effect of NaCl concentration on enzyme activity and stability of this strain was also studied and revealed that NaCl concentrations for the highest enzyme activity and remaining stability were 0.5% and 3.0%, respectively. This strain was identified as *Bacillus pumilus* using 16s rRNA gene. Further studies could lead to *in vivo* bioremediation and industrial applications.

Keywords: Protease, Salinity, Marine bacteria, Mangrove forest





Chitinolytic enzyme from soil bacteria against plant pathogenic fungi

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Soil samples from shrimp culture in Samutprakarn province were enriched in minimal medium with 0.3% colloidal chitin on rotary shaker 180 rpm at room temperature for 2 days. Only one isolated of chitinase producing bacteria (SM1) was found. The isolated SM1 was studied on morphological characteristics and biochemical properties. The isolated SM1 is a gram-positive bacterium, aerobic rod-shaped, swollen endospore, motile and able to produce catalase and oxidase. It can produce hydrolytic enzyme for starch, gelatin, skimmed milk and esculin. The isolated SM1 cannot grow in 5% NaCl and not use citrate and propionate as carbon source. 16S rRNA gene sequence was compared in the NCBI database and 98% similarity with *Paenibacillus phyllosphaera* strain PALXIL04. Chitinase activity on 0.1% glycol chitin plate under UV-light showed the largest diameter of clear zone on the third day of culture. The optimum pH of chitinase was pH 8. The molecular weight of this chitinase was estimated by 12% SDS-PAGE containing 0.01% glycol chitin as a substrate with approximate of 60 kDa. Antifungal activity of chitinase against *Helminthosporium oryzae*, *Rhizoctonia solani* and *Fusarium moniliforme* was determined. It was found that only *H. oryzae* was inhibited.

Key words: antifungal activity, chitin, chitinolytic enzyme





Enhanced of high level of β -xylanase production by *Bacillus pumilus* DMKUB39 from wood xylan using response surface methodology

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Currently, β -xylanase has been growing interest in a wide range because that can play a vital role in human consumption, animal feed, the paper industry, a component of pharmaceutical products, health products and it also used for xylooligosaccharides production. To gain these benefits, the aim of this research was enhanced of high level of β -xylanase production by high β -xylanase producing by *Bacillus pumilus* DMKUB39 at temperature of 40 °C using wood xylan, waste from pulp and paper industry companies, as the substrate. Plackett-Burman design was used for selection of components; wood xylan, peptone, K_2HPO_4 , KH_2PO_4 and $MgSO_4 \cdot 7H_2O$, which affected the production of β -xylanase enzyme. The results indicated that xylan wood and peptone were factors affecting the enzyme production. The optimized medium following by method one factor of the time for β -xylanase production found to be consisted of (g/l): wood xylan, 5; peptone, 10; K_2HPO_4 , 0.1; KH_2PO_4 , 0.1; $MgSO_4 \cdot 7H_2O$, 0.1. The maximum β -xylanase activity, 289.36 ± 0.88 U/ml, was obtained at the cultivation, initial pH 7.0 in 250 mL shaking flask of speed 150 rpm at 48 h. Scaling up to 5L stirrer fermentor, the maximal β -xylanase production of 446.69 ± 1.45 U/ml was obtained from the optimized medium at controlled pH 8.0, 1 vvm of aeration and 150 rpm of agitation. For characterization of crude enzyme, The maximum activity of β -xylanase were founded at pH 5.5 and 50°C, respectively. The β -xylanase was stable at pH of 5.0-11.0 and temperature of 50-60 °C. However, 66.3% of β -xylanase activity remained when kept at 50 °C for 1 h. It has been concluded that optimization of process enhanced the production of the enzyme and its characteristics of on make the applications feasible.

Keywords: *Bacillus pumilus*, β -xylanase, xylan, xylooligosaccharide





Rapid detection of *Campylobacter* spp. infection in broilers using Fluorescent dye-doped silica nanoparticles

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The objective of this study was to validate the fluorescent dye-doped silica nanoparticles (FDS-NPs) for the rapid detection of *Campylobacter jejuni* in a slaughter house. The FDS-NPs served as capture and potent signal reporter to the target pathogens, as such, reduced the detection time and equipment uses. FDS-NPs was synthesized using water in oil microemulsion and sol-gel technique. The particles were round with high photostability. The surfaces could be modified to attach biomolecules such as antibodies. Thousands of fluorescent dye (RUBY) molecules were encapsulated in the silica matrix resulted in extremely bright and stable light emission. The carboxyl functional group on FDS-NPs surface was clearly detected with FT Raman spectroscopy. Thousands of the antibody labeled FDS-NPs attached themselves to the surface of the *C. jejuni* and could be detected easily under the fluorescence microscope. Results of FDS-NPs for the detection of *C. jejuni* in samples were compared with conventional mCCDA plating and confirmed by the PCR method. When comparing the performance of two methods, it indicated that the relative accuracy, sensitivity, specificity of cloacal swab samples (n=60) were 98.33, 98.30 and 100%, respectively. The values for cecum samples (n=30) were 96.67, 96.43 and 100%, respectively. The inclusivity (*C. jejuni* ATCC 33291, ATCC 33560 and ATCC 81176) and exclusivity values (*Escherichia coli*, *Proteus mirabilis*, *Salmonella marcescens*, *Klebsiella pneumoniae*, *Shigella flexneri* and *Citrobacter freundii*) were both at 100%. It was evident that FDS-NPs was very specific and comparable or even better than the conventional method with shorter time, 30 min, compared with 5 days. It enables the slaughter house to effectively rearrange negative/ positive flocks to process. This step allowed the process to produce pathogen free broiler meat.





Effect of Growth Condition and Nutrient sources on Colony Surface Hydrophobicity and Hydrophobin Amount of Selected Mushroom

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Hydrophobins are small, about 10kDa-sized, surface active proteins strictly found in filamentous fungi and mushrooms. They are able to self-assemble into an amphipathic protein layer at hydrophilic/hydrophobic interface. The aim of this study was to investigate the effect of growth conditions and nutrient sources on colony surface hydrophobicity and hydrophobin extraction of mushrooms. Yanagimutsutake and unidentified wild mushroom (Unk14) were cultured on potato dextrose agar, and two synthetic media; Hopkins, mushroom minimal medium (MMM), varied in their carbon sources (glucose and glycerol) and nitrogen sources (KNO_3 and asparagine). Colony surface hydrophobicity was determined by value of water contact angle (WCA), which was higher than 90° , indicating hydrophobic. The WCA values of Yanagimutsutake and Unk14 colony surfaces on all agar media were ranging from 130° to 140° . For hydrophobin extraction, both mushrooms were cultured in static liquid media and hydrophobins were extracted from mycelia and culture media and analyzed by Bradford protein measurement and SDS-PAGE. The results showed that static PDB cultivation exhibited the highest WCA ($>140^\circ$) of colony surfaces and amounts of hydrophobin extracts. The expected hydrophobin protein was less-than-14kDa. Additionally, hydrophobins were extracted from stable bubbles when culture medium was blended. Extracted hydrophobins showed their surface conversion properties when coated on hydrophilic and hydrophobic surfaces, glass slide and parafilm, respectively. This study is very useful for an enhancement of hydrophobin production that is necessary for its industrial application in the future.

Keywords: Hydrophobicity, Nutrient sources, Water contact angle, Extraction, Stable bubble





Partial purification of a peptide with anti-gastric cancer activity from rice bran

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Cancer is a major cause of death worldwide. Currently, a number of food-derived peptides demonstrate anticancer activities with potential clinical applications. In this study, rice bran protein hydrolysates from twenty-three cultivars of Thai rice were obtained by digestion of the defatted bran proteins with pepsin, followed by trypsin. Anticancer activities of the protein hydrolysates against gastric carcinoma cell line (KATO-III, ATCC No. HTB103) were evaluated by colorimetric cell viability MTT assay. A human liver cell line (Chang Liver, CLS No. 300139) was used as a control normal cell line. Three of twenty-three bran protein hydrolysate from rice, Chaw-ma-gawk-klahng, Khao-dawk-mali 105 and Meuang-phan at 100 μg peptides mL^{-1} showed the most potent anticancer activities against the gastric cancer cells. They also showed less activities against human hepatocellular carcinoma cell line (HepG2, CLS 300198), and colon adenocarcinoma (SW620, ATCC[®] CCI-227[™]). The rice bran protein hydrolysate from Chaw-ma-gawk-klahng was isolated for the active peptide by subsequently ultrafiltrated through a 3 KDa cut-off membrane and a 1 KDa cut-off membrane, respectively. The ≤ 1 KDa peptide filtrate was purified by a C18 reverse-phase high performance liquid chromatography. Two peptide fractions eluted by 10% and 20% acetonitrile showed the most potent anticancer activities against the gastric cancer cells. This study is the first report of anti-gastric cancer peptides derived from Thai rice bran.

Keywords: rice bran, bioactive peptides, gastric cancer





Purification and Characterization of Pyruvate Kinase from Frog muscle.

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Polymerase chain reaction (PCR) is the most common technique used in scientific and medical research. Currently, deoxynucleoside triphosphates (dNTPs), one of the components used in the reaction, are imported from abroad such as the USA. Our laboratory is interested in enzymatic synthesis of dNTPs from deoxynucleoside monophosphates (dNMPs). One of the key enzymes in this process is the pyruvate kinase (PK, EC 2.7.1.40), which is used to convert all four NDPs (dADP, dCDP, dGDP, and dTDP) and dNDPs to their corresponding dNTPs and dNTPs, using phosphoenolpyruvate (PEP) as phosphoryl donor. By surveying pyruvate kinase from different source that include fish, shrimp and heart muscle, frogs muscle was found to have the highest pyruvate kinase specific activity when compared to other sources. Because frog muscle is readily available in Thailand and frog's pyruvate kinase has never been characterized before, the goal of my project is to purify and characterize this enzyme. After a good purification protocol had been established, the purified pyruvate kinase from frog muscle can be used for enzymatic synthesis of dNTPs. The pyruvate kinase of frog muscle was purified by (i) 30-70% Ammonium sulfate fractionation, (ii) ion exchange chromatography on a diethylaminoethyl (DEAE) cellulose column and (iii) gel filtration chromatography on a Sephadex G-200 column. From 280 gram of frog muscle, the yield of PK obtained was 5,240 units and had a specificity activity of 8.24 unit/mg. This represents a 5-fold increase in purity. The molecular weight this enzyme will be determined on a sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). The kinetic parameter of the enzyme such as K_m and V_{max} and subunit composition of the enzyme will also be determined.





Development of Gold Nanoparticles DNA-aptamer for Aquatic Disease Diagnostic

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Aptamers are single-stranded oligonucleotides that can bind to targets including proteins, carbohydrates, drugs, lipids, and other organic/ inorganic molecules. Aptamers specifically bind to their targets because of their molecular recognition properties. Gold nanoparticles (Au-NPs) colorimetric biosensors have been used as important applications in diagnostics. Commonly, the relevant nanoparticles are covalently modified with either a probe DNA or the aptamer such that hybridization or aptamer-target interactions. In aquaculture, leucomalachite green (LMG) which is the reduced form of malachite green (MG) can induce many aquatic diseases because LMG is highly toxic to mammalian cells (at concentrations as low as 0.1 mg/ml). In the experiment, we developed the detection of LMG based on the specific recognition of aptamer and color-indicator of gold-nanoparticles. To increase the number of LMG-aptamer, polymerase chain reaction (PCR) was used in this experiment and then the amplified aptamer was purified by phenol-chloroform method. The purified DNA product would be bound with gold-nanoparticles (20 nm in diameter). Gold-nanoparticles show the red color before binding with the LMG-aptamer and the solution turns to purple after the LMG-aptamer aggregates with gold.

Limulus amoebocyte lysate (LAL), obtained from horseshoe crab blood cells. LAL contains a coagulation system which is activated by bacterial lipopolysaccharide (LPS). LPS (bacterial endotoxin) is an important constituent of the cell wall of gram-negative bacteria. LPS interacts with multiple components of the blood of LAL, causing their aggregation and rapid degranulation. In the experiment, the selection of LAL-aptamer was performed by SELEX (Systematic Evolution of Ligands by EXponential enrichment). The screened aptamer at rounds 6 to 13 were determined their sequences by polymerase chain reaction, purification, ligation, transformation, plasmid extraction, digestion and sequencing respectively.

The results of this experiment showed that the LMG-aptamer can aggregate with gold because of the solution discoloration and found 8 of all LAL-aptamer. As a result, the LMG-aptamer can be developed to greater specificity for use as the biosensor for aquatic disease diagnosis.





Roles of polypyrimidine tractbinding protein (PTB) on function of hepatitis B virus post-transcriptional regulatory element (PRE)

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Hepatocellular carcinoma or HCC is major cause of cancer death worldwide and particularly in Thailand. In Asia and Africa, the main cause of HCC is hepatitis B virus (HBV) infection. Nowadays, new HBV infection can be efficiently prevented by vaccines. However, a large number of patients with chronic HBV infection do not have effective therapies without serious adverse effects. Furthermore, the available anti-HBV drugs increase rate of HBV mutation. To develop novel drugs, the mechanisms related to HBV replication must be investigated. Previously, *in vitro* studies have shown that the HBV post-transcriptional regulatory element (HBV PRE) binds to endogenous polypyrimidine tract binding protein (PTB). The interaction between PTB and PRE (PTB-PRE) are proposed to involve in mRNAs splicing and transport of HBV mRNAs from the nucleus to cytoplasm. This project therefore aimed to investigate roles of PTB on functional activities of PRE in the HCC cell line. To achieve the aim, this study employed two specific luciferase reporter constructs for studying export and splicing mechanisms namely pBasic and pSpliced, respectively. By co-transfecting pBasic with a plasmid expressing small interference RNA against PTB (pSiPTB) in the presence and absence of HBV PRE, the luciferase assay revealed that PTB knockdown weakly affected luciferase activity in the presence of PRE. This result suggests that PTB may not play its role in the nuclear export of HBV transcripts. However, more experiments are required to solidly confirm this point. Interestingly, addition of 100 ng of pSiPTB could significantly increase the luciferase activity of splicing system in the presence of HBV PRE. However, a greater reduction of PTB (more than 200ng of siPTB) suppressed the luciferase activity. The results may imply that other *trans* proteins act to compensate with the lost of PTB. In conclusion, these results suggest that PTB involves in splicing mechanism of HBV mRNAs, but further experiments are required to elucidate how PTB exactly regulate splicing mechanism of HBV transcripts.

Keywords: Hepatocellular carcinoma, Hepatitis B virus, HBV post-transcriptional regulatory element, polypyrimidine tract binding protein, small interference RNA.





Characterization of Anti-HIV-1 reverse transcriptase activities from Asian medicinal herbs

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The acquired immunodeficiency syndrome (AIDS) is a result of human immunodeficiency virus (HIV) infection which subsequently leads to significant suppression of immune functions. AIDS is a significant threat to the health of mankind, and the search for effective therapies to treat AIDS is very important. The reverse transcription entails the transition of the single-stranded viral RNA into double-stranded proviral DNA, which is then integrated into the host chromosome. Therefore, the HIV-1 reverse transcriptase (HIV-1 RT) plays a pivotal role in the life cycle of the virus and is consequently an interesting target for anti-HIV drug therapy. Several chemical anti-HIV agents have been developed. However, besides the high cost, there are adverse effects and limitations associated with using chemotherapy for the treatment of HIV infection. Thus, herbal medicines have frequently been used as an alternative medical therapy by HIV positive individuals and AIDS patients. In this study, *Acorus calamus L.* (rhizobium) were extracted by hexane, acetone, ethyl acetate, methanol and water which percent yield are 4.07%, 1.43%, 0.19%, 8.87% and 4.16% (w/w) respectively. Then the crude extracts was tested for inhibiting activity of the HIV-1 RT by using Reverse Transcriptase Assay Kit. The hexane fraction of crude extracts showed strong inhibition activity against the HIV-1 RT. Then the hexane crude extract was purified by column chromatography and thin layer chromatography techniques. The efficiency of anti-HIV-1RT activity was reported as IC₅₀. The compound was analyzed by mass spectrometry and NMR spectroscopy. Potential development of anti-AIDS compounds using molecular modeling methods will also be discussed.





Recombinant Expression and Characterization of a DNA ligase from *Geobacillus thermodenificans*

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DNA ligase catalyzes the linkage of two phosphodiester bonds between 3' hydroxyl ends of one nucleotide with the 5' phosphate end of another on two strands of DNA. DNA ligase can be divided into two broad classes, one requires NAD^+ as a cofactor and the other requires ATP as cofactor. All DNA ligases from prokaryotes appear to require NAD^+ as cofactor. All of the DNA ligase that has been encoded by eukaryote and virus require ATP. DNA ligase is commonly used in molecular biology laboratories for jointing two DNA fragments in genetic engineering. DNA ligases are used with restriction enzymes to create as recombinant DNA molecules. *Geobacillus thermodenificans* is a thermostable bacterium that had been isolated in our laboratory. DNA ligase from *G. thermodenificans* is an enzyme that requires NAD^+ as a cofactor for catalysis. This report describes expression and purification of this DNA ligase in *Escherichia coli* BL21(DE3) carrying pET28-geolig. After induction with 1 mM lactose, the recombinant enzyme was found to be soluble in supernatant when grown at either 37°C or 30°C. The enzyme in the supernatant was precipitated by addition of 0.5% PEI. The enzyme co-precipitated with the DNA in the pellet was extract with buffer containing 500 mM KCl and 1% Triton X-100 and further purified on a DEAE-cellulose column. The purified enzyme contains a single band and catalyze the formation of phosphodiester bonds between two DNA fragments.





Preparation and Characterization of CPP – shRNA nanoparticles for shRNA delivery in shrimp

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White spot disease is a disease caused by White Spot Syndrome Virus (WSSV). It caused the death of shrimp up to 80-100% within 4-5 days. Therefore, this disease damages a lot of the shrimp's export industry in Thailand. RNAi technology has gain attention and is widely studied for the protection of white spot disease in shrimp. However, RNAi technology is only effective in some level due to the limitation of nucleotide stability. In this study, we are interested in silencing the expression of gene *rr2* (ribonucleotide reductase small subunit) that is associated with the pathogenesis of white spot syndrome virus. To improve nucleotide stability, nanoparticles were prepared by mixing cell penetrating peptide, CPP, with short-hairpin RNA, shRNA that is specific to mRNA of *rr2*. Three species of CPP, peptide with the ability to transport molecules into cells, are selected which are R8, TAT and Penetratin. The peptides were synthesized using Fmoc-solid phase peptide synthesis. Then, peptides were purified by high performance liquid chromatography (HPLC) and purity were confirmed by mass spectrometry. To identify the optimal ratio between CPP and shRNA, gel retardation assay were performed. The result showed that each CPP binds with shRNA at difference ratio. The stability of the nanoparticles between shRNA and CPP was studied by digesting nanoparticles with nuclease and proteases and the stability of the nanoparticles was monitored by gel retardation assay. In addition, the toxicity of nanoparticles was studied by culturing sf9 cells with nanoparticles and cell viability were monitored by MTT assay. This study will determine the appropriate CPP concentration for transportation of shRNA into the cell for further development of nucleotide vaccine for the protection of white spot disease in shrimp.





Production of anticancer peptides from khoi (*StreblusasperLour.*) stem barks and seeds

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Khoi (*StreblusasperLour.*) is a tropical plant found in several countries, including Thailand. Various parts of Khoi have been used for traditional medicine. It is used to treat cancer, cholera, diarrhea, and dysentery. This study is interested in the production of bioactive peptides by mimicking digestion system in the body. The aim of this study is to identify amino acid sequence of peptides with anticancer activity. To produce anticancer peptides, Crude proteins were extracted from khoi stem barks and seeds using 0.1% sodium dodecyl sulfate (SDS) followed by acetone precipitation and dialysis. The digested proteins were produced by enzymatic hydrolysis using pepsin. The bioactive peptides were screened by 3.5 kDa membrane and partially purified using reverse phase high performance liquid chromatography (RP-HPLC). To test the cytotoxicity of partial purified protein hydrolysates, proliferation of oral squamous carcinoma cells (CAL-27) and human gastric carcinoma cells (KATO III) were examined using MTT assay. The results from khoi stem barks against KATO III cells revealed that at peptide concentration of 1 $\mu\text{g/ml}$, two fractions of partially purified peptides effectively reduced cell viability to around 90%. These peptides were eluted from C-18 column at approximately 18% and 40% of 0.1% TFA in 9:1 acetonitrile : ultrapure water. Cell viability was also compared with non-carcinoma cell from monkey kidney cells (Vero). The identity of toxic components was examined by proteinase K digestion. Peptides that reduce cell viability more than 50% will be analysed by liquid chromatography coupled with tandem mass spectrometry for peptide sequence identification.





Promoter Cloning and Expression Analysis of *Glyoxal oxidase* genes in *Chlamydomonas reinhardtii*

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Salinity stress is abiotic stress caused by non-living things that is common when the crops are grown under natural conditions. Salinity affects plant growth and reduced the yield of crop production. Plants that are grown under saline conditions will require an adaptation process in order to survive under the stress condition. The green alga, *Chlamydomonas reinhardtii* was used to generate the salt-adapted strain (SA). Alteration of both gene and protein expression profiles were observed under salt stress as well as the salt-adapted *C. reinhardtii* cells. One of the up-regulated genes belongs to the glyoxal oxidase enzyme family.

Glyoxal oxidase is a copper metalloenzyme. It catalyzes the oxidation of aldehydes to carboxylic acids, coupled to reduction of dioxygen to hydrogen peroxide. This enzyme contains an unusual free radical-coupled copper active site similar to that was found in galactose oxidase (GAOX). The objective of this research is to study *GOX* genes in *C. reinhardtii* wild type strain compared to that of the SA strain.

DNA, RNA and protein sequences of all available *C. reinhardtii* *GOX*s were retrieved from the National Center for Biotechnology Information (NCBI) and Phytozome databases. In total, 17 predicted *GOX* genes were found in the genome of *C. reinhardtii* including *GOX2*, *GOX3*, *GOX4*, *GOX5*, *GOX6*, *GOX7*, *GOX8*, *GOX9*, *GOX10*, *GOX11*, *GOX12*, *GOX13*, *GOX14*, *GOX15*, *GOX16*, *GOX17* and *GOX18*. Phylogenetic analysis showed the *GOX* family can be divided into small sub-groups. Five *GOX* genes were chosen in this study which are *GOX4*, *GOX7*, *GOX11*, *GOX15* and *GOX17*. Expression of these five *GOX* genes were analyzed by semi-quantitative RT-PCR. The results showed that *GOX7* and *GOX17* were exclusively expressed in the SA strain while their expressions were not observed in the wild type strain. However, *GOX4*, *GOX11*, and *GOX15* were not expressed in both SA as well as wild type. The partial cDNAs of *GOX7* and *GOX17* from salt-adapted strain were successfully cloned into pGEM-T® Easy vector and were subsequently transformed into *E. coli* by heat shock transformation. The transformants were selected by blue-white screening. The plasmids were digested with *EcoRI* restriction enzyme for verification of the presence of the insert and the clones were subsequently analyzed for their sequence by DNA sequencing. As the results of gene expression indicated that the expressions between wild type strain and salt-adapted strain are different significantly. Therefore, the promoter of *GOX* genes were analyzed for studying the regulation of *GOX* gene expression. The genomic DNA of the putative promoter from wild type strain and SA strain were extracted by CTAB method and were further analyzed by DNA sequencing.





Study of novel aldo-keto reductase in Thai Jasmine rice (KDML 105)

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Aldo-Keto Reductase (AKR) is an enzyme superfamily metabolizing aldehyde and ketone to the corresponding alcohol by using NADH or NADPH as the cofactor. The enzymes are involved in the metabolism of steroid, sugar, prostaglandin, succinic semialdehyde and other carbonyl compounds. In addition, AKR(s) are capable of metabolizing several toxic aldehydes such as methylglyoxal and HNE (hydroxynonenal) which are generated by lipid peroxidation. All members of mammalian AKR(s) belong to AKR1, AKR6 and AKR7 family, while the majority of plant AKR belong to AKR2 and AKR4 family. However, more than twenty AKR genes were found when searching rice genome databases, some of which belong to the AKR2 and AKR4 family, while the others couldn't be classified to any known family. This study aims to characterize these novel AKR; the result of which may lead to better understanding of aldehyde metabolism in rice. Two rice AKR genes *OsI_02879* and *OsI_21626* were investigated in this study. The genes were amplified by RT-PCR and were cloned into pGEM-T easy vector for sequencing.

Keywords: Aldo-keto reductase, Thai Jasmine rice (KDML105)





Production and characterization of G455A and S459V mutants of Dnbglu2

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□Glucosidases are enzymes which catalyse the hydrolysis of □glucosidic bond that links glucose and the other compounds. □Glucosidases from different sources are specific for various substrates, for example isoflavone glucoside, cyanogenic glucoside, cellobiose, phenolic glucoside and thioglucoside. Soybean isoflavones are a class of phytoestrogens that show health benefits in prevention of cancer, osteoporosis, postmenopausal symptoms and coronary heart disease. In plants, soybean isoflavones, such as daidzein and genistein, are present as isoflavone glucosides, such as daidzin and genistin, respectively, which are very poorly absorbed in the small intestine when compared with the free aglycone forms. Isoflavone glucosides need to be degraded to release free isoflavones before consumption. Three leguminous isoflavone □glucosidases, which are Dnbglu2 from *Dalbergia nigrescens* Kurz (blackwood), dalcochinase from *Dalbergia cochinchinensis* Pierre (Thai rosewood) and GmICHG from *Glycine max* (soybean), share between 60-80% amino acid sequence identity, but show different kinetic properties. Dnbglu2 hydrolyzes daidzin and genistin with high efficiency, while GmICHG was best in hydrolysis of soybean isoflavone glucosides with a modified group at the C-6 position, namely malonyldaidzin and malonylgenistin. So, we would like to identify the amino acid residues that are responsible for kinetic differences. So, in this study, two residues located in the substrate binding pocket of Dnbglu2 were changed to the same residues of GmICHG by site-directed mutagenesis, generating two single mutants of Dnbglu2 namely G455A and S459V. These mutants were expressed in *Pichia pastoris*, and purified by using phenyl sepharose column and Ni²⁺ sepharose column. Purity and identity was checked by sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PPAGE). The kinetic properties, namely K_m , k_{cat} , and k_{cat}/K_m of wild-type and mutant forms of Dnbglu2, were determined toward four soybean isoflavone glucosides, namely daidzin, genistin, malonyldaidzin and malonylgenistin. High Performance Liquid Chromatography (HPLC) was used to analyse the amount of free isoflavones released from the substrates. So, we hope to be able to identify amino acid residues that can contribute to high catalytic efficiency.





Biochemical Characterization of mature Plasmepsin V from *Plasmodium vivax* Thai isolate.

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Malaria, a major public health problem in tropical and subtropical regions, is caused by infection with *Plasmodium* parasites. Five species are known to infect humans (*P. falciparum*, *P. vivax*, *P. ovale*, *P. malariae*, and *P. knowlesi*); *P. vivax* accounts for 50-60% of all malaria cases in Western pacific and South East Asian countries. Due to the increasing number of multidrug-resistant strains, the development of new therapeutic agents with novel modes of action is mandated. To survive within erythrocytes, parasites deliver proteins into the host cell, using protein export mechanisms to remodel the infected erythrocyte and its surface. The majority of the exported proteins contain an N-terminal pentameric motif, RxLxE/Q/D termed *Plasmodium* export element (PEXEL). The PEXEL motif is proteolytically processed by Plasmepsin V (PMV). Processing by PMV is an essential step for export of PEXEL containing proteins and necessary for parasite viability. Therefore PMV is a promising new anti-malarial target. In order to biochemically examine PMV, we successfully produced soluble recombinant Trx-*Pv*PMVm-Thai using *E. coli* expression system. By using two fluorogenic peptides containing PEXEL motif, *Pf*EMP2 and HRPII, Trx-*Pv*PMVm-Thai preferentially hydrolyzed *Pf*EMP2 better than HRPII. To assess if Trx-domain interfere with the enzyme activity, *Pv*PMVm-Thai was produced from inclusion bodies, followed by rapid dilution refolding and the removal of Trx-domain using thrombin. The resulting *Pv*PMVm-Thai was confirmed by Western blot and LC-MS/MS analysis. Kinetic studies revealed that K_m values for *Pf*EMP2 and HRPII were 1.39 ± 0.18 and 0.96 ± 0.33 μM , respectively while the turnover number for *Pf*EMP2 and HRPII were 0.201 ± 0.014 and 0.053 ± 0.009 s^{-1} respectively. In addition, the substrate specificity study showed that *Pv*PMVm-Thai preferred a small polar amino acid at P₁' position since the mutation at P₁' position from Ser to Glu or Val dramatically reduced the enzyme activity. Inhibition studies also showed that PMSF, nelfinavir and menisporopsin A at 100 μM inhibited the enzyme activity by 50-75 % while at 10 μM only PMSF and menisporopsin A slightly reduced the enzyme activity. Taken together, these findings provided the new protocol to produce and enzymatically characterize *Pv*PMVm-Thai as well as insights into *Pv*PMVm-Thai substrate specificity and enzyme inhibition. This will be a useful platform for both structural study and the development of new anti-malarial drugs.

Keywords: Malaria, *Plasmodium vivax*, Plasmepsin V, PEXEL motif





Promoter Cloning and Characterization of ATP-Citrate Lyase gene (*ACLI*) from *Yarrowia lipolytica*

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Currently, biodiesel production from oleaginous microorganism is one of alternative energies in Thailand and foreign countries. *Yarrowia lipolytica* is oleaginous yeast, which is able to accumulate huge amounts of lipid in the cell. However, the mechanism of transcriptional regulation in lipid synthesis (*de novo* pathway) has not been identified yet. ATP-Citrate Lyase is a major enzyme which produced the precursor of lipid synthesis. Therefore, this project is interested in the control of expression on the promoter of *ACLI* gene in *Y. lipolytica*. First of all, to study a proper condition for accumulation of lipid droplet in different carbon sources, cells were stained with the Nile red dye and verified by fluorescence microscopy. The result showed that lipid droplets were observed in cell grown in both media containing glucose and oleic acid. However, the size of lipid droplet in medium containing oleic acid is larger than that in medium containing glucose. Furthermore, size of lipid droplet will be analyzed in medium containing other carbon sources and expression level of *ACLI* gene will be also analyzed in the proper condition for accumulation of lipid droplet.

On the other hand, to identify an important region involved in transcriptional activation on *ACLI* promoter, the different sizes of *ACLI* gene promoter will be cloned into the plasmid for promoter analysis. In this project, genomic DNA of *Y. lipolytica* (CXAU1 strain) was extracted for using as DNA template. The full promoter about 1 kb from start codon was amplified with specific primer by Polymerase Chain Reaction (PCR) and cloned into pGEM-T Easy vector. The recombinant plasmids were selected by blue-white colony screening and confirmed by restriction enzyme analysis. Then, the 1 kb-promoter fragment will be sub-cloned into pSUT5-lacZ between *Xba*I and *Stu*I sites. After that, the recombinant plasmid will be confirmed by DNA sequencing to check the sequence and the frame of codons in *LacZ* gene. Finally, the expression level of a reporter gene *lacZ* under the control of the full *ACLI* promoter will be analyzed in various carbon sources.





Activation of asiaticoside and madecassoside in *Centella asiatica* (L.) Urban post-harvest.

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Centella asiatica (L.) Urban is a small herbaceous plant which possesses anti-aging and wound healing property. The major bioactive compounds of the plant are asiaticoside and madecassoside which can activate the synthesis of collagen I and III, responsible for the wound healing and anti-aging property of the plant. However asiaticoside and madecassoside are often present at low level because of the plant variation and also the growth conditions. A previous report suggests that cold and dehydration stress can stimulate the accumulation of asiaticoside and madecassoside in *Centella asiatica* post-harvest. The objective of this study is to improve the conditions used in the post-harvest treatment to stimulate the accumulation of the bioactive compounds. The result suggested that the highest yield of asiaticoside and madecassoside will be obtained when the plant was stored at 12°C for 24 hours followed by dehydration at 34°C for 24 hours and 55°C for 3 hours. The activated *Centella asiatica* will be used for developing skin care product.

Keywords: *Centella asiatica*, bioactive compound, asiaticoside, madecassoside, collagen





**Anti-cancer activities of protein hydrolysate and hot water extracts
From *Ancanthusebracteatus* Vahl**

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Cancer is now the leading cause of death worldwide. Current treatments for cancer such as surgery, radiation therapy, chemotherapy and anticancer drugs have different limitations and they are associated with serious side effects. Alternative treatments are therefore required. This project aimed to investigate effects of protein hydrolysate and hot water extracts from *Ancanthusebracteatus* Vahl on liver (HepG2), skin (A431), colon (SW620) and breast (MCF7) cancer cells. By performing viability assay (MTT) with different concentration of extracts, the preliminary results indicated that 15,000 ng/mL of protein hydrolysate and 1,000 µg/mL of hot water extracts significantly decreased viability of HepG2, A431, SW620 and MCF7 compared with normal cells (Chang or Vero). Further experiments are required to confirm these anticancer activities.





Development of DNA vaccine for preventing Streptococcosis in Nile tilapia (*Oreochromis niloticus*)

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Nile Tilapia (*Oreochromis niloticus*) is a freshwater fish species which is the most economically important worldwide, especially in Thailand, where it is the most aquaculture production and a major cultured species. Streptococcosis disease caused by *Streptococcus agalactiae*, is a Gram-positive coccus and a caused invasive infection in farmed fish. The resulting in economics loss of aquatic industry, the threatening and the development of vaccination in fish to protect and prevent of the streptococcosis disease is being interested. In this research, Glyceroldehyde-3-phosphate dehydrogenase (GAPDH), Pyruvate kinase (Pyk), Glycosyltransferase (rgpB) and cell surface protein genes are membrane proteins of *S. agalactiae* which provide strong immunogenicity in animal model were designed as a rationale DNA vaccine. The efficacy of these DNA vaccines was also determined in the protection of *S. agalactiae* infection in Nile tilapia.

GAPDH, Pyk, rgpB and cell surface protein genes were amplified by PCR using specific primers. The PCR product with size corresponded to GAPDH (1,320 bp), Pyk (1,503bp), rgpB (966 bp) and cell surface protein (3,192bp) were purified and cloned into p-GEM-T easy vector to verify the identity of corresponded genes. Recombinant plasmids were transformed to *Escherichia coli* DH5 α for blue-white screening and digested with restriction enzyme sites by *Bam*HI/ *Not*I (GAPDH, Pyk and cell surface protein) and *Bam*HI/ *Xho*I for rgpB. Genes were ligated into pET32a and transformed to *E. coli* BL21 for expression to verify the immunogenic properties of target proteins. The recombinant GAPDH and Pyk showed approximately 70 kDa after Western blot analysis. Then genes were cloned into pcDNA3.1 (+) and used as a DNA vaccine for protecting streptococcosis in Nile tilapia. Ten gram tilapia were vaccinated with 100 μ l of pGAPDH, pPyk, pcDNA3.1 (+) and PBS by intraperitoneal injection. At 3-week after immunization, 10 fish were removed from each group and challenged with 200 μ l *S. agalactiae* (1×10^8 CFU/ml). After challenged, the mortality of fish were recorded for 14 days. The result indicated that the first trial of pGAPDH and pPyk provided lower efficacious. Although, pGAPDH and pPyk can induce only small promising immune system protective disease but this experiment will be enlighten on the development if other rationale designed vaccine to specific to *S. agalactiae*.





Production and characterization of the D400N and S454F mutants of Dnbglu2

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□ Glucosidases hydrolyse □ glucosidic bond in various glucoside substrates, generating glucose and glycone or aglycone moiety. One of these substrates is a class of isoflavone glucosides. In particular, the leguminous isoflavones, such as genistin and daidzin, can act as phytoestrogens, as they resemble human estrogen. Therefore, leguminous isoflavones have many health benefits, such as prevention of osteoporosis, cancers and postmenopausal symptoms. In plants, these isoflavones exist as isoflavone glucosides, which are very poorly absorbed in the small intestine as compared with free isoflavones. Therefore, to improve their nutritional values, these isoflavone glucosides need to be degraded to release free isoflavones before consumption. Leguminous isoflavone □ glucosidases include Dnbglu2 from *Dalbergia nigrescens* Kurz (blackwood) and GmICHG from *Glycine max* (soybean), which show 60% sequence identity. In previous studies, Dnbglu2 was shown to be highly efficient in hydrolysis of genistin and daidzin, but GmICHG was most efficient toward these substrates containing a modified group on the C-6 of glucose, such as malonylgenistin and malonyldaidzin. The aim of this study is to identify the amino acid residues that are responsible for these catalytic differences. So, in this study, two residues located in the substrate binding pocket of Dnbglu2 were individually changed to the corresponding residues of GmICHG, generating two single mutants, namely the D400N and S454F mutants. These mutants were expressed in *Pichia pastoris*, and purified to homogeneity. Next, their enzymatic properties toward four soybean isoflavone glucoside substrates, namely daidzin, genistin, malonylgenistin and malonyldaidzin, will be determined by HPLC analysis. It is hoped that this research can identify the amino acid residues that lead to an improved kinetic efficiency.





Cloning and Expression of Primary Oleate Regulator (*POR1*) in *Yarrowia* system

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Biodiesel production from oleaginous microorganisms has been an interesting alternative. *Yarrowia lipolytica* has high accumulation of lipids. Therefore, it has been studied of this yeast species as a renewable energy source in the future. Meanwhile, the control of lipid metabolism in this yeast is unclear. The previous report showed that Primary Oleate Regulator (Por1p) is a major transcription factor associated with control of genes in the beta-oxidation pathway in *Y. lipolytica*. Hence, this research will focus on the over-expression of Por1p for using to study mechanisms of transcriptional control by Por1p. Firstly, Por1p was over-expressed in pET system. A plasmid (pET15b-POR) was transformed into *Escherichia coli* BL21(DE3). After that, Por1p expression was induced with IPTG for 1-4 hour(s) at 37°C and analyzed by SDS-PAGE and western blot techniques. From these results, Por1p was not observed at size about 102 kDa-protein as expected size but was found at size about 17 kDa-protein as major band by detection of anti-His6x in immunoblotting analysis. To confirm that Por1p was cleaved inside *E. coli* cell, the initial kinetic of Por1p expression was investigated by using liquid nitrogen in order to stop the reaction within the cell. Por1p was observed at both sizes, 102 kDa-protein as expected size and 17 kDa-protein at induction time for 30 min, thereby suggesting that Por1p was unstable and actually degraded by some enzymes in *E. coli* into small fragments. Therefore, to solve this problem, the full length of Por1p was expressed in *Yarrowia* system instead. From previous study in *Y. lipolytica*, *PAT1* gene is inducible gene. When cells were grown in medium containing fatty acid and *n*-alkane, expression of *PAT1* gene will be increased. To create a novel expression system in *Y. lipolytica*, *PAT1* promoter will be used to drive the expression of target gene. Thus, *POR1* gene will be inserted instead of *LacZ* gene in pP1061, a plasmid containing *LacZ* gene under the control of *PAT1* promoter. The coding region of *POR1* gene was amplified with specific primers by Polymerase Chain Reaction (PCR) and cloned into pGEM-T Easy vector. White colonies were selected and confirmed by restriction enzyme analysis of recombinant plasmid. Then, the fragment of *POR1* gene will be sub-cloned into pP1061 between *StuI* and *BamHI* sites. After that, *POR1* gene will be confirmed by DNA sequencing to check the sequence and frame of codons. This plasmid will be transformed into *Y. lipolytica* by electroporation. Finally, this system will be tested in Por1p expression by induction with oleic acid in order to get enough Por1p for further study.





Identification and characterization of mannose binding protein gene in the black tiger shrimp, *Penaeus monodon*

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Mannose binding protein (MBP) is characterized as a calcium dependent lectin that plays an important role in innate immunity. The protein is mediate cell-surface carbohydrate-recognition events. We report here the identification and characterization of mannose binding protein in tiger shrimp, *P. monodon*, named *PmMBP*. The *PmMBP* gene was identified from an intestine of the shrimp using 5' and 3' rapid amplification of cDNA ends (RACE). The PCR product of 5'RACE (500 bp) and 3'RACE (600 bp and 1200 bp) were obtained and cloned into pGEM-T easy. Then, colony PCR and restriction digestion were carried out for confirmation. After sequencing and analysis, the full-length cDNA of *PmMBP* was 1249 bp, consisting of 5'-terminal untranslated region (UTR) and 3'-UTR with a poly(A) tail of 52 and 345 bp, respectively. An open reading frame (ORF) of 852bp encodes for a polypeptide of 284 amino acids with a signal peptide of 25 residues. The theoretical pI and molecular weight of *PmMBP* are 7.7 and 29369.7 Da, respectively. Tissue distribution showed that *PmMBP* transcript was highest expression in lymphoid organ and intestine. Hepatocyte, heart and gill showed a moderate expression level. Interestingly, no expression was found in hemocyte. For further experiment, a recombinant *PmMBP* will be produced and characterized. The result from this study could be useful for understanding of shrimp immune system.





Cloning and expression of transglutaminase II of the black tiger shrimp, *Penaeus monodon*

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Shrimp Transglutaminase II (STG II) is known to be involved in blood coagulation, the first line of defense and an integral part of overall shrimp immune system. STG II catalyses an intermolecular or intramolecular ϵ -(γ -glutamyl) lysine bond formation of clottable protein, resulting in a protein polymerization. However, several reports showed that STG II activity requires calcium ion. Moreover, our result from pull-down assay showed that calmodulin (CaM) can bind STG II. The CaM is one of the well-known signaling proteins reporting a ubiquitous intracellular Ca^{2+} ion. Thus, it is possible that STGII may be interacted with CaM in response to infection in shrimp. In the present study, we cloned a STG II from lymphoid cDNA. The STG II consists of a coding region of 2,274 bp encoding for 757 amino acid residues with a calculated mass of 85,000 Da and an isoelectric point of 5.48. Tissue distribution showed that the STG II transcript was expressed in all examined tissues. Then we will produce recombinant STG II protein and examine protein-protein interaction between the recombinant STG II and recombinant CaM with western blot analysis and fluorescence spectroscopy. Knowledge from this study could provide an insight into shrimp immune signaling system in response to pathogen infection.





Initial characterization and multidrug resistant protein identification of high and low metastatic nasopharyngeal carcinoma cell lines

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Nasopharyngeal carcinoma (NPC) is frequently diagnosed in Chinese and South Asian including Thai populations. A NPC-developing site is latent and difficult to be identified in an early stage of the disease. As a result, NPC-diagnosed patients are typically diagnosed when the cancer is already developed to a metastatic stage. At this metastatic stage, the patients have a high multidrug-resistant level for chemotherapy resulting in a low survival rate. It is hypothesized that the multidrug resistance is related to the metastatic stage and the gene expression level of the membrane transport proteins called ABC-binding cassette transporters (ABC transporter). Thus, the aim of this study was to characterize initial characteristics of two different NPC cell lines in high and low metastatic stages, 5-8F and 6-10B cell line, respectively. The characterization included a morphological study by using microscopic techniques, a cell proliferation rate by reporting a period of time that the cells require to have a double in population (doubling time). Moreover, cell migration and cell invasion studies were performed by using boyden chamber assays. Lastly, the gene expression of ABC transporter families including ABCC1, ABCG2 and ABCB1 were quantified by using quantitative polymerase chain reaction. From the microscopic technique, 5-8F cells showed a round morphology with a discrete patch pattern on a cultureware surface. The doubling time of the cells was 30 hours. As for 6-10B cell line, cells showed a spindle-shaped morphology with an equally distributed pattern on a culture ware surface. The doubling time of the 6-10B cells was 28 hours, less than 5-8F cells. The cell migration, cell invasion, and ABC transporter gene expression are still under investigation.





Cloning and Expression Analysis of Glyceraldehyde 3-phosphate dehydrogenases in *Chlamydomonas reinhardtii* under Salt Stress

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High concentration of saline in agricultural field is the most critical factor that can limit crop productivity. Salt stress affects plants in several ways. It causes inhibition of plant growth and in severe case it eventually leads to plant dead. To study the defense mechanisms that are utilized in plants, a unicellular chlorophyte, *Chlamydomonas reinhardtii* was used as a model. Among the variety of proteins that their upregulation were observed due to salt stress in previous proteomics research (Yokthongwattana, unpublished data), *C. reinhardtii* GAPDH protein (CrGAPH) is one of the proteins that increase its expression under salt stress as well as salt-adapted (SA) condition (cultured in Tris Acetate phosphate medium (TAP medium) with 300mM, NaCl). Glyceraldehyde 3-phosphate dehydrogenase (GAPDH) is an enzyme that catalyzes the conversion of glyceraldehyde 3-phosphate to 1,3-bisphosphoglycerate in the sixth step of glycolytic pathway. It possesses very similar enzymatic and molecular properties in a wide range of organisms.

C. reinhardtii sequences for DNA, RNA and protein of GAPDH (*CrGAPDHs*) were obtained from the publicly available databases (National Center for Biotechnology Information (NCBI), Phytozome and PlantGDB). Five of *CrGAPDHs* (*CrGAPN1*, *CrGAP2*, *CrGAP3*, *CrGAP1a*, *CrGAP1b*, *CrGAP1a/CrGAP1b*) are present in *C. reinhardtii* genome. Semi-quantitative reverse transcription polymerase chain reaction (RT-PCR) technique was employed to study expression of all *CrGAPDH* genes. Two genes, *CrGAPN1* and *CrGAP2*, were expressed stronger in the SA cells compared with that of the wild type which was consistent with the former proteomics research. Whereas no significant difference was observed in the expression of (*GAP1a/GAP1b*) transcription in SA cells compared with that of the wild type. The partial cDNAs of *GAP1a/GAP1b* were cloned and inserted into pGem-T® Easy vector. The positive clones with the insert were sent for DNA sequence analysis. Further analysis of the promoter region of these genes will be required for functional characterization of these genes under salinity stress condition. Information of both expression and the regulation of the *CrGAPDHs* might contribute to a better understanding of the mechanisms plants utilize under saline stress.





Morphology and Anatomy of leaf in the Genus *Cycas*L.

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A comparative study on morphology and anatomy of leaf in ten species of *Cycas*; *Cycas apoa* K.D. Hill, *C. balansae* Warb., *C. brunnea* K.D. Hill, *C. changjiangensis* N. Liu, *C. edentata* de Laub., *C. media* ssp. *banksii*, *C. media* ssp. *media*, *C. pectinata* Buch.-Ham., *C. platyphylla* K.D. Hill and *C. simplicipinna* (Smitinand) K.D. Hill. It was found that all species have once-pinnately compound leaves. Leaflet is linear with entire margin and leathery. The anatomical characters were observed and found that cuticular layers are thick and present on both adaxial and abaxial sides. Sunken stomata were found on abaxial side. There are one-three layers of hypodermis with different appearances. The hypodermis presenting at along the blade, leaf margin and around midrib were found in *C. pectinata*, *C. brunnea* and *C. platyphylla*; around midrib, close to midrib, leaf margin and close to margin were found in *C. edentata* and *C. media* ssp. *banksii*; around midrib, close to margin and leaf margin were found in *C. media* ssp. *media*; leaf margin and around midrib were found in *C. simplicipinna*, *C. apoa*, *C. balansae* and *C. changjiangensis*. Leaf mesophyll comprises palisade and spongy layers. Palisade layers are present on both sides of leaf (unifacial leaf). The adaxial palisade consists of longer cells than abaxial palisade. Transfusion tissue was observed in spongy mesophyll with transverse orientation. Midrib contains a vascular bundle which is surrounded by endodermis. Mucilagenous cavities were found in ground tissues of *C. media* ssp. *banksii* and *C. apoa*. In this study, it was found that the anatomical characteristics of *Cycas* leaves were different among species.

Keywords: Morphology, Anatomy, *Cycas*





Effect of Calcium Boron and Sorbitol on Pollen tube growth and Fruit set in Mango (*Mangifera indica* L.) cv. KhiewSawoey

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Mango (*Mangifera indica* L.) cv. KhiewSawoey was low rate of fruit setting under conventional plantation. Calcium and boron have been found to induce pollen germination and increase fruit set in mango. The essential function of calcium was impaired membrane stabilization and pollen tube extension. Boron was required for stigma receptivity and pollen tube viability. Sorbitol is a carbohydrate which transported in many plants. Objective of this research is to determined effects of calcium boron and sorbitol on pollen tube growth and fruit set in mango. Calcium and boron solutions (Ca 0.06%, B 0.02%) combination with 10%, 15% and 20% was spray to 5-10 centimeters length inflorescences. At one hour after pollination, calcium and boron show the high number of pollen grain attached to stigma. At 6 hours after pollination, calcium boron and 15% sorbitol could increase the best pollen tube growth. At 24 hours after pollination calcium boron and 20% sorbitol had the best pollen tube growth. Furthermore, treatment of calcium boron and 15% sorbitol could increase the best fruit setting. However, calcium boron and sorbitol had no effect on fruit weight and diameter. The results revealed that calcium boron and sorbitol can induce pollen tube growth, which related to increase fruit set in mango cv. KhiewSawoey.

Keywords: boron, calcium, pollen tube growth, sorbitol





Effect of humic acids on growth and yield of Cassava cv. HUAYBONG 80

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Effects of humic acids with the chemical fertilizers on the growth and yield of cassava cv. HUAYBONG 80 was determined. The experiments were consisted of 4 treatments: no fertilizer, 50 kg/rai chemical fertilizer, 37.5 kg/rai chemical fertilizer, and 37.5 kg/rai chemical fertilizer with 25 kg/rai humic acids. The results showed that there was no significant difference between control and treatments in stem diameter, SPAD index, stem height, nutrient content in fresh tubers, and starch content of cassava. However, the nitrogen content in fresh tubers in the treatment of 37.5 kg/rai chemical fertilizer with 25 kg/rai humic acids was significantly higher than control and other treatments. From the results, humic acids do not affect growth rate and productivity of cassava. However, increase of nitrogen content may be caused by humic acids which increase efficiency of nutrient absorption.

Keywords: humic acids, cassava, chemical fertilizer





Diversity of Domatia in Flowering Plants

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The diversity of domatia of flowering plants has been investigated in the area of Kasetsart University, Bangkhaen Campus during June 2014 to April 2015. Morphological and anatomical (cross section) characters of domatia on leaves of flowering plants were observed under stereo and compound microscopes respectively. It was found that there are 3 types of domatia, pit, pocket and hair turf on the leaves of eight species from six flowering plant families as the following; pitted domatia in *Coffea arabica* L. (Rubiaceae) and *Terminalia ivorensis* A.Chev. (Combretaceae), pocket domatia in *Hopea odorata* Roxb. (Dipterocarpaceae) and *Cinnamomum porrectum* (Roxb.) Kosterm. (Lauraceae), hair turf domatia in *Combretum constrictum* (Benth.) M.A.Lawson (Combretaceae), *Triplaris cumingiana* Fisch. & C.A.Mey. (Polygonaceae), *Jasminum sambac* (L.) Aiton (Oleaceae), and *Gardenia carinata* Wall. ex Roxb. (Rubiaceae). These results revealed that domatia types are not relatable to plant families. More than one domatia types may occur in some flowering plant families. From this survey pitted and hair turf domatia could be found in Rubiaceae and Combretaceae.

Keywords: diversity, domatia, flowering plants





Comparative Phytochemistry and Cytotoxicity of *Gnetum gnemon* L. Extracts

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Comparative phytochemical investigation of the lipophilic leaves (young and mature) extracts from *Gnetum gnemon* L. has been done during January 2014 to December 2014. By mean of chromatographic technique i.e. Thin Layer Chromatography (TLC) and High Performance Liquid Chromatography (HPLC) it was shown that coumarins, steroids, phenolic compounds and essential oils are constituents in the both extracts. The effect of the extracts against brine shrimp was also investigated in order to evaluate cytotoxicity. Eight concentrations of the lipophilic extracts 0, 12.5, 25, 50, 100, 250, 500, and 1000 $\mu\text{g/ml}$ were tested with brine shrimp on 96-well microtiter plates. The results were measured in 24 hours. The results showed that at the concentration 1000 $\mu\text{g/ml}$ of lipophilic leaves extracts is the most effective to brine shrimp.

Keywords: *Gnetum gnemon* L., leaves extracts, lipophilic, brine shrimp





Effect of *Brassinosteroid Mimic* (DHECD) on growth and yield of rice (KDML105) under saline soil

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The brassinosteroids are the plant hormone reported to alleviate salt stress. This study investigated the response of rice (*Oryza sativa* L.) cv. KhaoDok Mali 105 (KDML105) on 7,8-dihydro-8 α -20-hydroxyecdysone (DHECD) under saline soil in field experiment. The treatments consists of ; non chemical application, foliar DHECD concentration 0.00001 μ M, 0.0001 μ M and 1 μ M were sprayed 2 times at vegetative (V5) and grain filling period. The experientwith 4 replication in Randomized Complete Block Design (RCBD) were employed. The results showed that the concentration of substance DHECD result no difference in growth and yield of rice. However, compared to non chemical application, the results showed that application of DHECD could increased straw dry weight, seeds weights, number of seeds per panicle and yield per area. There indicated that DHECD alleviated salt stress of rice cultivar 'KhaoDok Mali 105' by increase yield per area of rice under saline soil compared with non treated.

Keywords: 7,8-dihydro-8 α -20-hydroxyecdysone, DHECD, yield, rice, saline soil





Morphology, Anatomy and Pollen Morphology of the Genus *Santisukia* Brummitt (Bignoniaceae) in Thailand

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Morphological study of the genus *Santisukia* Brummitt (Bignoniaceae) in Thailand was conducted from February 2014 to February 2015. Two species are enumerated, *Santisukia kerrii* (Barnett & Sandwith) Brummitt and *S. pagetii* (Craib) Brummitt. Morphological descriptions, distribution and some ecological aspects are provided. The differences based on morphological characters are number of compound leaf at each node, shape and width of corolla tube, color of flower, the presence of tubercles on outer surface of calyx and pericarp, and hairs on rachis of inflorescence and pedicel. Both species are endemic to Thailand and restricted to limestone hill. *S. kerrii* occurs in the Northern, the Northeastern and the Central regions. *S. pagetii* is confined to the Southwestern region. The conservation status based on IUCN Red List Categories and Criteria version 2001 of these two species are vulnerable. Anatomy of stem and leaf and pollen morphology of these two species were studied. The results showed that the anatomical and pollen morphological data do not provide characters for identification within the genus.

Keywords: Endemic plant of Thailand, limestone hill, vulnerable plant





Comparative Phytochemistry and Effect of Rang Chuet (*Thunbergia laurifolia* Lindl.) Extracts on Seedling Growth of Some Plants

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Comparative phytochemical investigation of the lipophilic leaves and bark extracts from *Thunbergia laurifolia* Lindl. We're investigated during January 2014 to December 2014. By mean of chromatographic technique i.e. Thin Layer Chromatography (TLC) and High Performance Liquid Chromatography (HPLC) It was shown that triterpenoid, steroids, phenolic compounds and essential oil are constituents in the lipophilic leaves and bark extracts. Moreover, coumarins could be observed in lipophilic bark extract. The effect of lipophilic leaves and bark extracts against weeds and cultivated plants was also investigated. Five concentrations of the lipophilic extracts i.e. 0, 2.5, 5.0, 7.5 and 10 mg/ml with 4 replications per treatments were tested for inhibition of seed germination and seedling growth (shoot and root length) on two weeds included giant mimosa (*Mimosa pigra* L.) and southern sandbur (*Cenchrus echinatus* L.) compare with two cultivated plants, mung bean (*Vigna radiata* (L.) R. Wilcz.) and rice (*Oryza sativa* L. cv. Pathum Thani 1). At the 7th day after germination, the number of germinated seed was counted and also, shoot and root length were measured in each treatments. The results showed that the lipophilic leaves and bark extracts could inhibit seed germination of southern sandbur at all the concentrations. At the concentration 10 mg/ml of lipophilic bark extract could inhibit seed germination of giant mimosa and rice, but at the same concentration of lipophilic leaves extract could inhibited seed germination of rice. However, the lipophilic leaves and bark did not affect seed germination of mung bean. All concentrations of lipophilic extract could affect shoot and root length of all tested plants.

Keywords: Comparative Phytochemistry, *Thunbergia laurifolia* Lindl., weeds, germination, seeding growth





Developmental Anatomy of Flower, Fruit and Seed in Tropical Waterlily cv. LarpPrasert

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The developmental anatomy of flower, fruit and seed in tropical waterlily cv. LarpPrasert was studied. Flowers at various stages and fruits were collected and made into permanent slides by paraffin method. The specimens were observed under light microscope. It was found that there are numerous glands on exocarp of ovary. The pericarp consists of parenchyma and collateral bundles. There are several carpels per ovary. The number of carpels may reduce when the ovary is mature. Fruit is a berry containing anatropous ovules. Seed is surrounded by aril. Fruit maturation takes 2 weeks from blooming stage.

Keywords: developmental anatomy, *Nymphaea*, tropical waterlily





Phytochemistry and Effect of Candle bush (*Senna alata* (L.) Roxb.) Extract on Seedling Growth of Some Weeds and Cultivated Plants

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This research aims to make a chemical profiles and look for possibility of *Senna alata* (L.) Roxb. extract as herbicide. So, the experiment was divided into two parts. First, phytochemical analyses using High Performance Liquid Chromatography (HPLC) and Thin Layer Chromatography (TLC). Second, study on biological activities of *S. alata* lipophilic leaves extract. Five concentrations of the extract i.e. 0, 2.5, 5.0, 7.5, 10.0 mg/ml were tested for inhibition of seed germination and seedling growth (shoot and root length) on two weeds included *Pennisetum pedicellatum* Trin. and Giant mimosa (*Mimosa pigra* L.) compared with two cultivated plants, rice (*Oryza sativa* L. cv. Pathumthani 1) and lettuce (*Lactuca sativa* L.) for seven days after planting. Results from phytochemical analyses showed the identity of *S. alata* which is useful for *S. alata* identification. Moreover, it was shown that lipophilic leaves extract from *S. alata* composes of coumarins, anthraquinones, steroids, other phenolic compounds and volatile oils. The results from biological activities tests demonstrated that the lipophilic leaves extract from *S. alata* was able to inhibit seed germination of *P. pedicellatum* and *M. pigra* at the concentrations 5.0, 7.5 and 10.0 mg/ml and inhibited seed germination of lettuce at all concentrations, but was not able to inhibit seed germination of rice. All concentrations were able to inhibit seedling growth of *P. pedicellatum*, *M. pigra*, *Oryza sativa* L. cv. Pathumthani 1 and *L. sativa* except the extract at the concentration 2.5 mg/ml could stimulate shoot elongation of *M. pigra*.

Keywords: Phytochemistry, *Senna alata*, germination, seedling growth, weeds





Morphological and Anatomical Characteristics of some Ornamental *Nymphaea* in Thailand

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Morphological, anatomical and palynological characteristics were studied in ten cultivars of waterlilies including; Chompoo-Nix, Pinvaree, Sermlarp, Red Spider, Sulfurea, Minuta, Lustrous, Mrs.Edward Whitaker, Islamorada, Sirious and General Pershing. Shape and color of underground stem, young leaf, mature leaf, petiole, peduncle, young flower, mature flower and ovary were observed under stereo microscope. Leaf blades are orbicular and ovate. The leaf margin are erose and entire types. Anatomical characteristics of underground stem, blade, petiole, peduncle and ovary were observed under compound microscope. The studied 10 cultivars can be classified using the difference of septa. The morphological characteristics of pollen were studied by standard method under compound microscope. It was found that there are various types of shapes and sizes.

Keywords: anatomy, morphology, palynology, *Nymphaea*





Effects of 7, 8-dihydro-8 α -20-hydroxyecdysone on KDML 105 rice treated with NaCl under greenhouse conditions

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The effects of 7, 8-dihydro-8 α -20-hydroxyecdysone (DHECD) on rice cv. 'KDML105' treated with NaCl solution under greenhouse conditions were investigated. Rice seeds were pre-treated with 10^{-11} M DHECD for 24 hr. before germinating and treated with NaCl solution that had an electrical conductivity at 0 and 5 mS/cm. At the 4th and 7th weeks after germination, 0, 10^{-11} - 10^{-9} M DHECD were foliar applied. The survival rate, growth and some ions content were studied compare with non-pretreated plants. On the 12th week after germination, the result showed that salt stress plants at all concentrations of DHECD had lower survival rate and dry weight of root and shoot than the control and non salt stress plants. In additions, the content of Na⁺ and Cl⁻ in salt stress-rice plants were higher than non salt stress plants, and the content of Na⁺ and Cl⁻ in shoot were higher than in root. For K⁺ content in salt stress plants was much lower than non salt stress plants. In term of MDA content, there were not different in all treatment. These results indicated that DHECD at all concentrations did not alleviate salt stress in vegetative phase of KDML 105 rice.

Keywords: brassinosteroid analogue, DHECD, salt stress





Effects of light intensity and CO₂ on leaf net photosynthetic rate of commercial Philodendron cultivars

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Photosynthetic rate was studied in commercial Philodendron 10 cultivars, consist *Philodendron* 'Elephant ear', *Philodendron* 'Moon light', *Philodendron* 'sun light', *Philodendron selloum*, *Philodendron* 'Grape', *Philodendron squamiferum*, *Philodendron* 'Xanadu', *Philodendron* 'Gloedii', *Philodendron* 'Paint lady' and *Philodendron* 'Lemon lime'. The study effect of light intensity showed that light compensation point (LCP) was approximately 4-40 $\mu\text{mol m}^{-2}\text{s}^{-1}$ and light saturation point (LSP) was around 200-700 $\mu\text{mol m}^{-2}\text{s}^{-1}$ in all 10 cultivars of Philodendron. Under different carbon dioxide concentrations, the photosynthetic rate will be increased when carbon dioxide is higher level. That indicated carbon dioxide compensation point is 180-400 ppm. Furthermore, range of leaf greenness is about 15-65 SPAD unit which depend on species. Philodendron leaves were exacted to evaluate total chlorophyll content that is around 3-25 mg/cm^3 and there is a linear relation between greenness and chlorophyll content of leaf. In conclusion, photosynthetic rate of Philondenron leaf demonstrated that are shade tolerant plants. They required low light intensity for photosynthesis and had ability to photosynthesize in high carbon dioxide concentration.

Keywords: Photosynthesis, Philodendron, Light, Carbon dioxide





Effect of kaolin clay on photosynthesis efficiency, yield and quality of pineapple in summer season

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The fruit setting of pineapple in summer season always confront with high temperature and high light intensity which caused sun-burn of leaf and fruit of pineapple. These effects also reduced the photosynthetic capacity, number of fruit and the quality of pineapple. Kaolin is a natural clay material and Thailand is one of the current largest kaolin producers. The white clay kaolin is characterized as reflective materials that can be applied as a leaf or fruit particle film coating to reduce solar heat stress, thus it could increase the photosynthetic capacity and reduce sun-burn pineapple fruit and leaf. The study on effects of foliar application of kaolin on photosynthesis capacity, number and quality of pineapple fruit compare to the conventional fruit bagging was investigated. Kaolin from Lampang and Utaradit sources were used as reflective material by foliar application of 50 gL^{-1} kaolin once, twice and four time a week in summer season at 14 weeks of fruit age. The results showed that foliar application of both source produced a lower leaf chlorophyll fluorescence, leaf temperature, fruit temperature, sun-burn of leaf and fruit than the fruit bagging method, meanwhile, there were no significant difference in chlorophyll a and b content in the pineapple leaves. Foliar application of kaolin from Lampang and Utaradit sources significantly produced a higher fruit yield and fruit size than the fruit bagging and control group. However, there was no significance different in total soluble solid and tritable acidity in pineapple fruits between the treatments and the control group.

Keywords: kaolin, pineapple, sun-burn pineapple, fruit qualities, chlorophyll fluorescence





Inhibition of HIV-1 protease activity by the natural extracts of Thai medicinal plants

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The human immunodeficiency virus-1 protease (HIV-1 protease) is a retroviral aspartyl protease (retropepsin) that is essential for the life-cycle of HIV. Inhibition of HIV-protease activity will disrupt its ability to replicate and infect the cell. The natural extract of Thai medicine plants might serve as an alternative way to treat the AIDS patients. This study aimed to identify the efficacy of peptide extracts from Thai medicinal plants against HIV-protease. Four Thai medicinal plants, Wan-Nang-Kum (*Curcuma aromatica Salisb*), Makham-dee-khwaai (*Sapindus emarginatus Wall*), Hya-Hnud-Maew (*Orthosiphon aristatus*) and Purk-Khoi (*Streblus asper Lour*) were used. The peptide extracts of these four plants were fractionated by various concentrations at 10%, 20%, 40%, 60% of acetonitrile. The result showed that at 20% acetonitrile fraction of Wan-Nang-Kum and 10% acetonitrile fraction of Hya-Hnud-Maew could inhibit the recombinant HIV-protease activity. The IC_{50} of Wan-Nang-Kum and Hya-Hnud-Maew were found at 0.02925 mg/ml and 0.01085 mg/ml, respectively.





Differential cDNA expression in *Jatropha curcas* flowers

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Jatropha curcas is a monoecious plant that has more male than female flowers on the same inflorescence. Understanding genetic control of cellular development in male and female flower is important to improve *J. curcas* in the future. At department of Genetics, complementary DNA-amplified fragment length polymorphism (cDNA-AFLP) was used to study differential gene expression in young male and female floral buds and found eight sequences that expressed differently in both sexes. This research aimed to confirm the expressions of these transcript derived fragments (TDFs) in male and female flower along with leaf and young shoot. Primers designed for specific TDFs were used in reverse transcription polymerase chain reaction (RT-PCR) and confirmed the expression patterns of these fragments identified by cDNA-AFLP.





Screening the drug-like molecules against Fis, a transcription factor of *Pasteurellamultocida*

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Pasteurellamultocida is a Gram-negative that can cause multi-host disease. This bacterium causes atrophic rhinitis and pneumonic pasteurellosis in pig, fowl cholera in avian and hemorrhagic septicemia in cattle. Fis is a transcription factor which regulates other genes that are involved in capsule biosynthesis genes. If Fis is inactivated, it will result the loss of capsular polysaccharide production in *P.multocida* and decrease expression of virulence factor. This study aimed to screen the drug-like molecules against Fis function which will result decreasing of virulence factor expression. Virtual screening approach was used to screen the small molecules that could bind to Fis. The top-scoring compounds, ribavirin, fludarabine phosphate, D, N-methylglucamine, vidarabine monophosphate and adenosine were purchased. Hyaluronic acid assay will be employed to investigate the compound efficacy whether these compounds could inhibit Fis function.





Molecular evolution studies on the *hsf2* gene of *Pasteurella multocida* associated with diseased pigs, cattle and water buffaloes in Thailand

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Pasteurella multocida is a gram-negative bacterium that causes economically important diseases in Thailand including acute haemorrhagic septicemia in cattle and water buffaloes, and chronic pneumonic pasteurellosis in cattle and pigs. The *hsf* gene is an important virulent gene in *P. multocida* encoding for a large surface protein, called trimeric autotransporter adhesin Hsf. This protein functions in attaching bacterial cells to the upper respiratory tract of the animal hosts. Previous studies revealed two copies of this gene, *hsf1* and *hsf2*. This project aimed to investigate molecular evolution of the *hsf2* gene of bovine and porcine strains of *P. multocida* in Thailand by using PCR, nucleotide sequencing and bioinformatics analyses. Three primer pairs (*hsfA*, *hsfB*, *hsfC*) were designed from conserved *hsf2* regions of strains PM70, 3480 and HB03 in the NCBI database. The *hsf2* genes of three porcine strains associated with pneumonia in Thailand (PM7, S3 and KY2) were successfully amplified and sequenced. The obtained nucleotide sequences were compared and showed sequence variation at stalk region of the Hsf2 protein. Comparison of our results with strains in the genome database showed variations in the same regions. We are currently examining variations of this gene in the bovine strains of *P. multocida*. Molecular variations within this genes could be the result of host adaptation allowing us to understand virulent mechanism and disease pathogenesis of this bacterium.





Investigating heteroplasmy presented in mtDNA control region of *Portunus pelagicus*

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Mitochondrial control region (*mtCR*) contains the largest number of variant sites compared to other parts of the mitochondrial genome. Nucleotide sequences of this region have been used as a DNA marker for identifying maternal relatives, estimating genetic variation and revealing genetic structure of the populations. These applications are based on the assumption that each individual carries only one form of mitochondrial DNA (mtDNA) called homoplasmy and mtDNA is maternally inherited. However, mtDNA heteroplasmy, a mixture of multiple forms of mtDNA, have been observed in various organisms. This study aimed to investigate mtDNA heteroplasmy presented in the *mtCR* of *Portunus pelagicus* and its inheritance pattern. After screening 16 mother-offspring pairs using polymerase chain reaction (PCR) and Sanger sequencing, we observed two pairs that potentially carried mtDNA heteroplasmy. By aligning all sequences against each other as well as to the reference sequence, 82 polymorphic sites with 63 potentially heteroplasmic sites were observed. The length of aligned sequence was 438 bp. In addition, the pairwise comparisons of mtDNA sequences between mothers and their offspring showed that percent identities were in the range of 94% to 100% which may be caused by the presence of mtDNA heteroplasmy. These results suggests that the presence of mtDNA heteroplasmy could affect the use of *mtCR* as a marker for identify maternal relatives.





Pleiotropic drug resistance gene responding to arsenic uptake in rice and sticky rice

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Recent reports on the chemical residues on ricegrain indicated that rice grain has beencontaminated with Arsenic (As) from contaminated wet soil. Rice plants are susceptible to As accumulation when grown under flood condition. After As uptake via a plant's root cells, Asbecome a toxic substance to plant cells. Therefore, theATP-binding cassette (ABC) transporter protein namely–Pleiotropic Drug Resistance (PDR) acts asa transport proteininvolvingAs detoxification and reduction of accumulate As in plant. In this study, the PDR from *Oryza sativa* L.*indica*, cv. KhaoDawk Mali 105 was isolated and its expression response to As treatment was evaluated. The obtained partial cDNA PDR clone from leave of KhaoDawk Mali 105 rice consisted of 256 base pairs which showed 98% nucleotide similarity to *Oryza sativa* L. *japonica* (NM_001050076.1) and *O. sativa* L. *japonica* (AK121722.1), respectively. After one week As treatment, the expression patterns of PDR in two brown rice cultivars including Riceberry and KhaoKum rice were greatly up-regulated with similar patterns when real-time PCR was used to evaluate. But the PDR gene expression in KhaoDawk Mali 105 rice was gradually decreasing and it was stable in Korkhor 6 rice.





Effects of Optical Tweezers on DNA stability in *Saccharomyces cerevisiae*

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Optical tweezers are scientific instruments used to trap dielectric spheres, viruses, bacteria, living cells, organelles, small metal particles, and even strands of DNA. Though a lot of applications involve with living cells, not many studies have been done to assess any harmful effect on the DNA structure. The objective for this research is to study effects of optical tweezers on DNA stability in *Saccharomyces cerevisiae* cells after being trapped with optical tweezers at different light intensities and durations using five microsatellite markers. Results revealed that SSN6 primer showed no difference between wild-type and yeast that were trapped at 200 mW for 30 minutes and 250 mW for 60 minutes. For other markers the results were inconclusive and needed to be repeated.





Pleiotropic drug resistance gene responding to paraquat uptake in rice and sticky rice

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Paraquatherbicide is the most worldwide use. However, regular exposure to high doses of paraquat will cause to serious health problem in particular effect from paraquat accumulation in rice plant. To reduce the paraquat accumulation in rice, Pleiotropic drug resistance gene (*PDR*) ordinary involves as protein transporter belonging to ATP-binding (ABC) protein family. In this study, *PDR* expression pattern responding to paraquat uptake in four rice cultivars (*Oryza sativa* L. *indica* cv. KhaoDawk Mali 105, Riceberry, Korkhor 6 and KhaoKum) was evaluated. After one week paraquat treatment, leave and roots of four rice cultivars were immediately collected, RNA extracted and real-time PCR analysis. Interestingly, the PCR results showed that, after exposure to paraquat (25 μ M), the expression of *PDR* was slightly up-regulated in brown rice both in Riceberry and KhaoKum seedling, in contradictory to the expression of *PDR* in KhaoDawk Mali 105 and Korkhor 6 was dramatically down-regulated after 1 day paraquat treatment.





Development of functional DNA markers for resistance and susceptible alleles of rice blast resistant gene, *Pi37*

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Rice blast disease caused by a fungal pathogen, *Magnaporthe oryzae*, is one of the most devastating diseases in rice production worldwide. Most prudent and feasible strategy to manage this disease is using disease resistant varieties. *Pi37* is one of blast resistant gene, present in the rice cultivar St. No. 1. *Pi37* is located on chromosome 1. The transcript length of *Pi37* is 3,873 bp. The deduced *Pi37* open reading frame encodes a 1,291 residue polypeptide. The objective of this study was to develop the functional DNA markers for resistance and susceptible alleles of rice blast resistant gene, *Pi37*. Ten candidate positions for marker development were identified by comparing the sequence of resistance and susceptible allele. These ten positions are related to changes amino acids and covered by recognition site of restriction enzyme. SNP741 is the one of candidate position for marker development was used for screen rice blast disease resistant gene in Thai landrace cultivars. From a total of 105 landrace cultivar rice, 62 contain resistant allele and 43 contain susceptible allele. Most landrace rice from the north east of Thailand contains the resistant allele. The information from this study will be useful for development of new blast resistant elite rice cultivars in the future.





Investigating heteroplasmy presented in *mtCOI* of *Portunuspelagicus*

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Mitochondrial cytochrome oxidase I (*mtCOI*) is a subunit of complex IV functioning in oxidative phosphorylation (OXPHOS). The partial sequence of *mtCOI* gene has been used for species identification. This application is based on the assumption that each individual carries only one form of mitochondrial DNA (mtDNA) called homoplasmy. However, mtDNA heteroplasmy, a mixture of two or more forms of mtDNA, have been observed in various organisms. This study aimed to investigate mtDNA heteroplasmy in *mtCOI* of *Portunuspelagicus* and to comprehend its transmission pattern from mothers to their offspring. We sampled 16 mother-offspring pairs, extracted their genomic DNA, amplified partial *mtCOI*, and then sequenced the PCR products using Sanger sequencing method. The sequence data was aligned against each other as well as to the reference sequence. The polymorphic sites, heteroplasmic sites and percent identities were calculated from the aligned sequences. The results showed 15 polymorphic sites out of aligned sites out of 630 aligned sites. All of these variants are synonymous mutations with no sign of mtDNA heteroplasmy. Most mtDNA haplotypes presented in the mothers were also carried by their offspring; however, the comparisons of mtDNA sequences between mothers and their offspring showed percent identities in the range of 99.4-100 %. These results supported the use of *mtCOI* as a marker for species identification; however, the small differences between mothers and their offspring and the limitation of Sanger sequencing on detecting mtDNA heteroplasmy suggested that a more sensitive sequencing technique should be applied to confirm these results.





Development of microsatellite markers in Australian giant waterlily and DNA barcoding *Nymphaea* 'Chongkolnee'

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Waterlily, known as “Queen of Aquatic Plants”, is in the Nymphaeaceae family that can be divided into different genus. The genus *Nymphaea* is divided into two groups, Syncarpiae and Apocarpiae. The Apocarpiae group consists of two subgenus *Brachyceras* and *Anephyta*. *N. 'Chongkolnee'* is an interesting waterlily in subgenus *Brachyceras* that is native to Thailand and considered unusual and rare dating back to more than 700 years ago during the Sukhothai period. The Australian giant waterlily (*N. gigantea*) is in subgenus *Anephyta* and is found in permanent water with deep mud in tropical and subtropical Australia. It is a beautiful waterlily with large blue-white flowers and can adapt well to Thailand environment. Every year, new waterlilies from open pollination, intersubgeneric and interspecific hybridizations have been introduced from breeders all over the world. No information on the hybrid confirmation at molecular level has been reported. Genetic information of waterlily is also very limited. Microsatellite (MS) or simple sequence repeat (SSR) marker is an ideal genetic marker due to their dense distribution throughout the genome, high reproducibility, co-dominant alleles and highly variable nature. The objectives of this study were to develop MS markers of the Australian giant waterlily and used for genotyping waterlilies in the genus *Nymphaea* for specific identification and hybridity test. Moreover, DNA barcoding was generated at the ITS region of rDNA in *N. 'Chongkolnee'* and the DNA sequence was compared to other plants.

Keywords: Microsatellite marker, ITS rDNA, Australian giant waterlily, *Nymphaea* 'Chongkolnee'





Nucleotide conservation of VSAREP satellite DNA in Varanidae

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Satellite DNA (stDNA) VSAREP sequence family, which were isolated from the water monitor lizard (*Varanus salvator macromaculatus*) in our previous study stDNA, were located at the C-positive heterochromatin in the pericentromeric region of chromosome 2q, the centromeric region of chromosome 5, and three pairs of microchromosomes. To investigate nucleotide specificity and mutation rate of VSAREP in varanid lizard lineage, we molecularly cloned and sequenced VSAREP from Asian varanids (*V. salvator macromaculatus*, *V. salvator komaini*, *V. salvator sulfer*, *V. salvator ziegleri*, *V. bengalensis*, *V. rudicollis*, *V. dumerilii*, and *V. salvadorii*), Australian varanids (*V. acanthurus*, *V. gouldii*, and *V. rosenbergi*), and African varanids (*V. exanthematicus*, *V. niloticus*, *V. jobiensis*, and *V. obor*) using PCR based approach. Mitochondrial *ND2* gene of each species was also cloned and sequenced to compare the genetic relationship between two data sets, and evaluate rate of nucleotide mutation. The results showed that VSAREP has probably arisen after Asian and Australian varanids had diverged from African varanids approximately 40 million years ago. The polymeric ladder DNA bands found in Asian varanids suggest that VSAREPs was arranged in tandem arrays in Asian varanid genomes, but not in its Australian varanid relatives. The present results lead us to understand the evolutionary process of VSAREP and that the stDNA are promising markers to identify cryptic species in the lineage of varanids.





Phylogenetic analysis of fireflies (Coleoptera: Lampyridae) in Thailand based on mitochondrial *16s rDNA*

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Fireflies (lightning bugs) are classified in order Coleoptera, family Lampyridae. They can produce light in their abdomens by bioluminescent reaction. There are about 2,000 species of fireflies in the world and only 15 species are reported in Thailand. Originally, firefly species were identified using only morphological characters for example pronotum, elytra and abdominal segments. However, by using only the morphological characters to identify species can cause taxonomic confusions in some complex species. Therefore, molecular data have recently been incorporated to facilitate species identification. The molecular data in combination with the morphological data have been proven to be useful in species identification and in phylogenetic inference studies. In this research, we aim to assess species diversity of fireflies in Thailand and to analyze the phylogenetic relationship among them using mitochondrial *16S ribosomal RNA* gene. This *16s rDNA* has both highly conserved and variable regions permitting easy amplification of the gene and able to be used to infer phylogeny. Twenty species of firefly were collected throughout Thailand. Phylogenetic trees were constructed with Maximum likelihood, and Neighbor Joining methods with 1,000 bootstrap replicates. The result showed two main clades. Clade I, subfamily Luciolinae contained three groups, *Pyrophanes/Pteroptyx*, *Luciola/Pygoluciola* and *Asymmetricata* groups. Clade II, subfamily Lampyrinae contained two groups, *Pyrocoelia* and *Rhagophthalmus* groups. Although this marker can be used to identify most species, however closely related species i.e *Pyrophanes* and *Pteroptyx* were unable to be separated. Therefore, other DNA marker will be incorporated to distinguish these closely related species in the future.





Molecular evolution studies on the tight adherence (*tad*) locus of *Pasteurella multocida* associated with diseased pigs, cattle and water buffaloes in Thailand

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Pasteurella multocida is a Gram-negative bacterium that causes acute and chronic diseases in cattle, pigs and water buffaloes in Thailand. Previous studies identified various virulence genes of *P. multocida*, but variation of these genes in different animal hosts and diseases have not been completely answered. This project aimed to investigate molecular evolution on the tight adherence (*tad*) locus of *P. multocida* strains associated with diseased pigs, cattle and water buffaloes in Thailand using PCR, nucleotide sequencing and bioinformatics analyses. The *tad* locus encodes for type IV fimbriae protein complex which functions in cell surface adhesion. Six *tad* locus-specific primers (*tad*-1, *tad*-2, *tad*-3, *tad*-4, *tad*-5 and *tad*-6) were designed based on sequences of *P. multocida* strains in the NCBI database. Genomic DNAs of four porcine strains associated with pneumonic pasteurellosis cases in Thailand (PM2, PM7, KY2 and S3) were amplified with these primers and sequenced. The obtained nucleotide sequences of this locus were compared between these four strains. Initial results showed sequence variations and different genetic arrangement of the *tad* locus of these four porcine strains. Similar results were found when comparing the sequences of the *tad* locus of these four strains to six other strains (PM70, 3480, 36950, HB03, ATCC 43137 and HN06) of *P. multocida* in the NCBI genome database. This project is currently examining this locus in the bovine strains. The complete molecular evolutionary comparison of the *tad* locus will shed light on differential adhesion mechanisms and pathogenesis of this bacterium.





Karyological characterization of head and neck cancer cell line HN4, HN12, HN30 and HN31 using classical G-banding, C-banding and DAPI staining

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Karyological characterizations of two pairs of head-and-neck cancer cell lines (HN4-HN30 and HN12-HN31) were performed using G-banding and C-banding. HN4 and HN30 were obtained from primary lesion in clinical stage III. HN12 and HN31 cell lines were obtained from the lymph node metastatic lesion in clinical stage IV. Chromosome number of HN12 and HN30 were $2n = 54$, while that of HN4 and HN30 were $2n = 57$ and 63 , respectively. Analysis of G-banded cancer chromosomes in HN30 cell line showed the loss of chromosome segments on chromosome number 7, 8, and 9 at 7p14, 7q3, 7q35, 8p23.1, 8p12, 8q24.2, 9p24, and 9q33. C-positive bands were detected in the centromere region of all chromosomes in all cell lines. Large C-positive bands were found on chromosomes 13, 14, and 15 of HN4 and HN30 cell lines. A dicentric chromosome which was involved chromosome 1 was found in HN12. The present results show the presence of chromosome aberration in four head-and-neck cancer cell lines which were preliminary data to investigate the alteration of genome under molecular level next.





Pleiotropic drug resistance gene responding to glyphosate uptake in rice and sticky rice

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Gene expression is the process by which gene information is presented as the synthesis of a functional gene product. In this study, the expression of Pleiotropic drug (PDR)-ATP-binding (ABC) protein in rice responding to glyphosate was evaluated. Glyphosate is a broad-spectrum systemic herbicide. As PDR involved in the detoxification and reduction of accumulate glyphosate in plant. Therefore, four rice cultivars (*Oryza sativa* L. *indica* cv. KhaoDawk Mali 105, Riceberry, Korkhor 6 and KhaoKum) were treated with 50 μ M glyphosate for one week. Then PDR transcripts were extracted from roots and leave of treated rice and evaluated for their expression patterns by real-time PCR. After one week glyphosate treatment, leave of rice showed yellowing and growth retardment. Surprisingly, the expression of *PDR* in three rice cultivars including KhaoDawk Mali 105, Riceberry and Korkhor 6 were slightly up-regulated in the first day of glyphosate treatment, and then the gene expression level become normal. However the sticky and brown rice, KhaoKum was considerably up-regulated after 1 day glyphosate treatment.





Comparison of two snake gametologous genes, *CTNNB1* and *WAC* for development of molecular sexing PCR based marker

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Two snake gametologous genes (*CTNNB1* and *WAC*) were selected for development of molecular sexing with thirteen snake species. A PCR primer set of *CTNNB1* gene was constructed from our previous study, and a PCR primer set of *WAC* gene was designed to amplify intron 9 region of the gene. Heteromorphic sex bands (one band in male and two bands in female) of both *CTNNB1* and *WAC* were found in *Homolopsis buccata* from Homolopsidae, *Boiga dendrophila*, *Coelognathus flavolineatus*, and *Gonyosoma oxycephalum* from Colubridae, and *Naja kaouthia* and *Ophiophagus hannah* from Elapidae. However, heteromorphic sex bands were found only in *CTNNB1* gene in *Daboia siamensis* from Viperidae, *Oligodon fasciolatus* from Colubridae, and *Ahaetulla prasina*, *Xenochrophis flavipunctatus*, and *Naja siamensis* from Elapidae, and only in *WAC* gene in *Xenopeltis unicolor* from Xenopeltidae. This suggests that the combination of two molecular sexing markers is effective for sex identification of these thirteen snake species examined. On the other hand, *Cylindrophis ruffus* from Cylindrophiiidae, *Python bivittatus* from Pythonidae, and *Bungarus candidus* from Elapidae were present homomorphic bands in both males and females. The presences of insertion/deletion (indel) have occurred in *CTNNB1* and *WAC* genes, which were specific in each snake lineage, though these two genes are located on the same chromosome arm. This suggests that the two gametologous genes on snake sex chromosomes have independently undergone nucleotide mutation. Analysis of the two gametologous gene sequences is a promising step to extensively investigate the evolutionary process of snake sex chromosomes.





Testing of chemical conditions for oil palm embryogenesis in tissue culture

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Oil palm tree (*Elaeis guineensis* Jacq.), a monocot plant, is origin from western Africa. Oil palm is now the largest source of edible oil in the world mainly used for economic production. It is grow throughout Africa, Asia North America and South America. In Thailand has an area palm oil cultivation more than 3 million acres. Due to across pollination nature of oil palm, individual palm seed show variable field performance because of their genetic heterogeneity. The present time tissue culture was used as a method to large scale propagation of oil palm tree. But this method takes a relatively long period of time. From previous research found that *LEC1* and *BBM* genes are involved in the regulation of the somatic embryogenesis in oil palm during tissue culture. Both genes expressed at high level during somatic embryogenesis including globular, torpedo, cotyledon and plantlet stages. To shorten the time of embryogenesis stage during oil palm tissue culture by *LEC1* and *BBM* promoter analysis. Sucrose were added to callus induction medium (N6) three different concentrations at 30 g/l (control), 60 g/l and 90 g/l. After 2 weeks callus in 90 g/l N6 medium shown the small white spot on callus, and after 4 weeks in 30 g/l N6 medium shown growing callus and turn green. The expression of *LEC1* and *BBM* in this sample will be examined by RT-PCR. The result from this study will be used in the future to shortening oil palm tissue culture process.





Cloning of autophagy genes in potato

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Autophagy is a self-degradative process that is important for balancing sources of energy. It also plays a housekeeping role in removing misfolded or aggregated proteins, clearing damaged organelles, as well as eliminating intracellular pathogens. *Solanum tuberosum* is used as model plant in this research to clone autophagy genes. DNA sequences of *ATG1*, *ATG7*, and *ATG8* from plants were used to design primers and polymerase chain reaction was done on *S.tuberosum* cDNA. The PCR fragment was ligated into pGEM[®]-T Easy vector and transformed into *Escherichia coli* (DH5 α) and isolated plasmids were sent for sequencing. Obtained sequence chromatogram contained multiple overlying traces and not readable, the experiment will need to be repeated.





Performances of the Gas Electron Multiplier (GEM) detector in gamma detection from Am-241

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The Gas Electron Multiplier (GEM) detector is a new type of gaseous detector that was invented by F. Sauli and his associates from CERN, Switzerland, in 1997. The GEM detector has several advantages over previous gaseous detectors including the ability to operate in most gas fillings, an excellent position resolution ($\sim 50 \mu\text{m}$) and a high rate capability. The GEM detector has capabilities of detecting electromagnetic radiation such as X-ray and gamma ray, and also ionizing particles such as betas and alphas. In particular, low-energy electromagnetic radiation such as 59-keV gamma ray from Am-241 can pass through the GEM's window and ionize gas within the drift region of the GEM detector to create groups of primary electrons. These ionized electrons will then be increased in energy by strong electric fields between each GEM foil and ionize further gas molecules to create electron avalanches large enough to be captured and read by read out. This research focuses on characterizing performances of GEM detector in gamma detection from Am-241, which has the energy in the range of 59 keV released during the process of turning Am-241 into Np-237. The characterization includes the study of the effects of gas types and their flow rates that have on the uniformity and gain of the GEM detector.





Radioprotective effect of berries fruit in human lymphocytes

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The objective of this study was to antioxidant capacities of functional *Antidesmagmaesembilla* or mamao and *Syzygiumcumini* or java plum. These fruit have reddish purple fruits that contain high amount of anthocyanin which can reduce a risk of cancer and eliminate toxin from the body. Total antioxidant capacity were studied using 3 methods ; 2,2-Diphenyl-1-picrylhydrazyl radical scavenging assay (DPPH), 2,2'-azinobis (3-ethylbenzothiazoline-6-sulfonic acid) ABTS assay and Ferric reducing antioxidant power (FRAP) assay. From the result , the java plum was showed the highest antioxidant activity. DPPH assay (EC_{50}) of plum was 150 $\mu\text{g/ml}$, ABTS assay was 78.63 $\mu\text{g/ml}$ and FRAP assay was 67 $\mu\text{g/ml}$. From radioprotective effect of Java Plum by Cytokinesis-Blocked Micronucleus assay showed that Java plum can reduce Micronucleus about 56.25% and 87.5% at concentration of 50 and 100 $\mu\text{g/ml}$, respectively. The result showed java plum can be using for radioprotective agent.

Keywords: Anthocyanin, Antioxidant capacities, Cytokinesis-Blocked Micronucleus assay, *Antidesmagmaesembilla* and Java Plum





Preliminary Study of Using Comet Assay for Dose Estimation in Hair Root Cells

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Hair root cells are expected to be sensitive to radiation as they undergo rapid proliferation. The present research aims to explore the potential use of comet assay to investigate DNA damage in human hair root cells for radiation dose assessment. The samples of hair root cells were obtained from healthy volunteers who had not done hair dyeing during the last three months. The hair samples were divided into 5 specimens. One specimen was used as control. The other four specimens were irradiated with doses of 1, 2, 3 and 4 Gy using Cs-137 gamma irradiator (Mark I) at a dose rate of 6.4 Gy/min. The DNA damages in hair root cells were determined immediately using the comet assay technique. The comet parameters, tail length (TL) and tail moment (TM) were used to indicate the damage of DNA. The results showed that both TL and TM significantly increased in the exposed samples compared to control. The degree of DNA damage increased with the absorbed dose. The present study indicates the possibility of applying the comet assay to determine the DNA damage in hair root cells for dose estimation in patients after radiation accidents.





Measurement of Radon-222 in Groundwater Using Ultra Low Level Liquid Scintillation Counters

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Radon-222 is a radioactive inert gas produced by the alpha-decay of Radium-226 in the Uranium-238 series with a half-life of 3.825 days. As Radon-222 occurs naturally in the earth's surface in rocks and soil more than 50% of the total radiation dose from all sources of natural ionizing radiation is absorbed by the public. High concentrations of Radon - 222 inhalation has a hazardous effect on public health. In this study, focus on the measurement of Radon-222 in groundwater in Bangkok metropolitan area using toluene solvent extraction method. The measurement of Radon-222 had been taken using Ultra - Low Level Liquid scintillation counter (LKB Wallace Model Quantilus 1220). The condition of measurement followed in the previous study, the ultra-low level liquid scintillation counter has pulse shape analysis (PSA) for separate alpha and beta assess the activity of ^{226}Ra standard solution and the optimum PSA was selected by condition of interference that selected at 175. The result showed that the calculation of the Radon-222 extraction coefficient (Fw) was average at 0.948 ± 0.002 and the efficiency of alpha ultra-low liquid scintillation counter was average at 0.321 ± 0.040 and in mobile liquid scintillation counter were 0.281 ± 0.042 , which had been found statistical significant at 2σ . The Minimum Detectable Activity (MDA) of ultra-low liquid scintillation counter was average at 0.047 Bq/L. We found that the Radon concentrations are different from the previous study.

Keywords: Radon-222 measurement, Groundwater sample, LSC





Gamma Irradiation of Silk Fiber on Molecular Weight Reduction for Agricultural Purposes and Fermentation of Protease

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Silk fiber is composed of two protein, fibroin and sericin. Silk fibroin (SF) is a natural fibrous protein spun from silkworm, while sericin is a glue-like protein surrounding the fibers to hold them together in the cocoon case. Recently, the possibility of producing valued devices from low cost waste silk fiber is a subject of broad interest and is being studied for famous textile industry, new biomedical and agricultural application. This work focuses on utilization of silk waste from sericulture industry; the yellow- and white-silk wastes were exposed with Gamma irradiation from Cobalt-60 at dose of 100 kGy. The result showed that the yellow-silk waste gave the high protein content extracted with water. In the study of fermentation of protease, yellow-silk waste was determined as raw medium for the enzyme production since the highest extracted protein with water. To select the high potent strain on protease production, a total of 12 isolates from 19 isolates were selected base on their ability of clear zone formation on skim milk agar plate. Among 12 strain, strain S3-2 gave the highest protease activity in the basal medium contained irradiated yellow-silk waste as raw material. The optimized medium determined by "one factor at a time method" for the protease production was found to be consisted of (g/l): irradiated yellow-silk waste fiber, 1; glucose, 5 and K_2HPO_4 , 1.5. The maximum protease activity, 1.19 ± 0.14 U/ml, was obtained at cultivation, in 250 ml shaking flasks of speed 200 rpm at 48 h. We have also investigated the changes in the molecular structure and physiological activities using Fourier Transform Infrared Spectroscopy (FT-IR) and X-ray diffraction (XRD) patterns. The morphology of the silk wastes fiber is characterized by using *scanning electron microscope (SEM)*. The Gamma-irradiation technique is useful for development of valuable silk protein as biomaterial.

Keyword: Silk Fiber, Gamma irradiation, Fermentation, Molecular weight





Performances of the Gas Electron Multiplier (GEM) detector in Beta detection from Sr-90

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Gas electron Multiplier (GEM) detector is designed for low energy particle detection by using gaseous in signal amplification. The detector was invented in 1997 by the Gas Detector Development Group at CERN by Fabio Sauli. The GEM detector has several advantages, for instance, it can be operated in most gas fillings, and has the proportional gains up to 105. In addition, GEM detector has the space localization accuracy (position resolution) of 50 μ m. The aims of this research is to study performances of the GEM detector in beta detection from Sr-90 by using two-gas mixture of Ar/CO² gas for signal amplification. The effects of flow rates and pressure of the mixed gas that have on uniformity and gain of the detector are investigated. Furthermore, the gain of the detector for different voltages supplied is also investigated using the amplitude of signals.

Keywords: GEM detector, Gas electron Multiplier detector





Antioxidant activity and Radioprotective effect of Pericarp of mangosteen in human lymphocytes : An in vitro evaluation

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In normal everyday human's received radiation from multiple sources. The radiation is everywhere in nature and caused by man-made radiation. The inevitable which in turn are followed, it will be different, depending on the dose, given that there is plenty to do. By disorders such as causing free radicals. Micronucleus and other in the cells, which often lead to health problems and the risk of disease. This experiment was conducted to study the antioxidant activity and radioprotective effect properties for example 3 crude extract from vegetable is Pericarp of mangosteen, Sangyod Brown Rice and Purple corn cob. The Study of 3 crude extract from vegetables experiments conducted in vitro. The study of the effects of antioxidant and their anti-radiation by means of experimental features two methods: Method one test chemical to dissuade radicals by DPPH assay, ABTS assay and FRAP assay results. Tested methodist ethanol Pericarp of mangosteen has properties of a substance that is able to withstand high antioxidant activity, with an EC50 as 95 $\mu\text{g}/\text{mL}$. Method two test biological properties about the effect of radioprotective effect from Pericarp of mangosteen way. Micronucleus assay results in blood samples irradiated acute. Results showed that Pericarp of mangosteen has a radioprotective effect can reduce Micronucleus about 61.02 % and 91.12% at concentration of 50 $\mu\text{g}/\text{mL}$ and 100 $\mu\text{g}/\text{mL}$.

Keyword: Antioxidant activity, Radioprotective effect, Micronucleus assay, DPPH assay, ABTS assay and FRAP assay





Radioactivity measurements gross alpha and beta particles in sea water from Gulf of Thailand with Liquid Scintillation Counter

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The gross alpha and beta radioactivity measurements in sea water samples by Ultra-Low Level Liquid scintillation counter (LKB Wallace Model Quantilus 1220). The LSC can be separated alpha-beta spectrum to measure low-level radiation in the environment.

In this study the optimum PSA (pulse shape analysis) was selected optimum condition of the PSA value at 175 by using the scintillation cocktail is Optiphase Hisafe3 and the volume ratio between sample/Hisafe3 of 6:14 at 60 minute counting time. The sea water from 8 station areas around the Gulf of Thailand. The measure gross alpha and beta activities values are as follows, samutsongkhom (10.853 ± 0.428 cpm, 59.059 ± 0.998 cpm), Bangkok (14.756 ± 0.455 cpm, 38.309 ± 0.959 cpm), Trad (38.925 ± 0.658 cpm, 110.844 ± 0.997 cpm), Chachoengsao (10.853 ± 0.428 cpm, 44.965 ± 0.871 cpm), Songkhla (11.762 ± 0.412 cpm, 42.556 ± 0.921 cpm), SuratThani (15.223 ± 0.398 cpm, 49.702 ± 0.799 cpm), Petchaburi (15.394 ± 0.510 cpm, 48.257 ± 0.903 cpm), Nakhon Si Thammarat (18.702 ± 0.467 cpm, 37.354 ± 0.697 cpm) respectively.

Keywords: gross alpha and beta, sea water, LSC.





Effect of Radiation on Ion-exchange Resins

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Ion-exchange resins are used to purify radioactive waste waters in the Thai Research Reactor-1/Modification 1 (TRIGA MARK III) of Thailand Institute of Nuclear Technology (Public Organization). The total generating capacity of the research reactor is 2 MW with 500 tons and 800 tons force cooling systems. The uniform particle size separable mixed bead ion exchange resins are used for production of ultra-pure water, called Dowex monosphere MR-3UPW. The functional groups of the resin beads are sulfonic acid and quaternary ammonium. The maximum operating temperature is 60 °C. In general, the resins are used to remove radioactive elements and other impurities from cooling water. They are utilized for the water treatment for one year. So, the resins are contaminated with radionuclides such as Co-67, Se-75, I-131, Cr-51, La-140, Cd-115, Kr-85, Sb-122, Y-88, Sb-124, Mn-54, Zn-65, Co-60, Cs-137, Cs-134 and Na-24. Typically, the contaminated resins have been kept in plastic and steel containers for long term storage or disposal. In this study, the morphology of the ion-exchange resins were measured by electron scanning microscope (SEM) and chemical structure of the resins has been analyzed by Fourier transform infrared spectroscopy (FT-IR). The Dowex monosphere resins with ultra pure water were loaded to 20 ml cylindrical glass vials. The samples were irradiated up to 800 Gy at 25 °C in a ¹³⁷Cs Mark I irradiator (J.L. Shepherd & Associates) of Gamma research center, Faculty of Science, Kasetsart University. The sample vials were placed in the center of a polystyrene holder which was positioned in the middle of the chamber of the irradiator where the dose rate was 12 Gy min⁻¹. The dose rate was determined with a Fricke dosimeter. The irradiated resin beads were soaked in ethyl alcohol at room temperature before scanned by SEM. The results of SEM shown that at the radiation dose 20, 40, 60, and 80 Gy, the morphology of resins beads was still normal, meanwhile 100, 200, 400, 600 and 800 Gy, the resin beads were cracked or broken after irradiation. The percentage of cracking resins as compared with control (0 Gy) was 5, 5.71 11.5, 12.5 and 20%, respectively. In case of the chemical structure damage, it could be shown by FT-IR. The project has also planned to use FT-IR to confirm the radiation damage of the irradiated resins for low dose. The experiments of FT-IR are actually in process.

Keywords: Ion-exchange resin, morphology, Irradiation, SEM, FT-IR





Development of radiation survey meter with CsI(Tl) scintillation detector

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A radiation survey meter base on CsI(Tl) scintillation detector has been developed. The detector was assembled in aluminum housing by coupling 1 inch in diameter of CsI(Tl) with Photomultiplier tube model XP3112 and using Teflon tap as a reflector from scintillated light. Low noise high voltage circuit board was designed to supply 800 volt to XP3112. The counting unit was developed by using Arduino Nano to measure signal pulse from detector and calculate absorbed dose and display on TFTLCD. The survey meter was calibrated with Cs-137 radiation source at SSDL laboratory. It was found that the detection sensitivity and accuracy of developed survey meter were 1,500cpm/nSv-hrand $\pm 10\%$, respectively. The performances of the developed survey meter was acceptable to be used as a survey meter for radiation protection instrument.





Measurement of Uranium – 238 (^{238}U), Radium – 226 (^{226}Ra) and Potassium – 40 (^{40}K) in Rock Phosphate Fertilizer Samples of Different Size Geometries by High – Purity Germanium (HPGe) Gamma Spectrometer

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Radioactivity of uranium – series radionuclides in import rock phosphate fertilizer samples were measurement using a high – purity germanium (HPGe) gamma spectrometer. The specific activity of Uranium – 238 (^{238}U), Radium – 226 (^{226}Ra) and Potassium – 40 (^{40}K) in 20 rock phosphate fertilizers from Australia and Cambodia (from Agricultural Chemistry Division) were measurement and the IAEA – CU – 2008 – 03 (phosphogypsum sample) reference standard material was used to calculated the specific activity of Uranium – 238 (^{238}U), Radium – 226 (^{226}Ra) and Potassium – 40 (^{40}K) in rock phosphate fertilizer samples. The Cesium – 137 (^{137}Cs) and Cobalt – 60 (^{60}Co) reference standard source was used to calibrate the measurement system for energy calibration. The counting time for each rock phosphate fertilizer sample was 100000 seconds. The specific activity results in different size of sample container geometry were measured. The results of the specific activity in five rock phosphate fertilizer samples from Australia of cylinder geometry from 11.0 cm. diameter and 10.5 cm. height were found Uranium – 238 (^{238}U) were 73.72 ± 7.03 , 74.07 ± 8.38 , 99.69 ± 9.70 , 96.36 ± 8.83 and 85.01 ± 9.22 Bq/kg, respectively. The specific activity of Radium – 226 (^{226}Ra) were 55.88 ± 0.59 , 57.57 ± 0.64 , 63.23 ± 0.72 , 65.28 ± 0.65 and 61.63 ± 0.75 Bq/kg, respectively. The specific activity of Potassium – 40 (^{40}K) were 8.42 ± 0.45 , 8.82 ± 0.48 , 10.36 ± 0.57 , 8.92 ± 0.62 and 10.58 ± 0.55 Bq/kg, respectively. The results of the specific activity of cylinder geometry from 8.5 cm. diameter and 6.0 cm. height of Uranium – 238 (^{238}U) were 81.32 ± 7.03 , 86.26 ± 8.38 , 72.26 ± 8.14 , 92.85 ± 9.17 and 85.01 ± 8.61 Bq/kg, respectively. The specific activity of Radium – 226 (^{226}Ra) were 55.66 ± 0.63 , 56.45 ± 0.60 , 61.92 ± 0.72 , 60.48 ± 0.76 and 62.20 ± 1.60 Bq/kg, respectively. The specific activity of Potassium – 40 (^{40}K) were 9.16 ± 0.47 , 9.51 ± 0.49 , 10.28 ± 0.54 , 9.56 ± 0.34 and 9.90 ± 0.66 Bq/kg, respectively.





Development of a radioactive survey robot

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This research was aimed to develop a robot for surveying radioactive hotspot automatically base on POP-BOT XT robot with onboard Arduino microcontroller and 3 radiation detectors of Geiger–Müller with 9.1 mm effective diameter were placed in front of a robotas radiation detectors. The measurements of radioactive dose rate were performed by three detectors which were arranged in angle of 60 degree to another detector and radioactive dose rates could be measured separately. An automatic robot could find position of radioactive hotspot from radioactive dose rates difference in each detector by adjusting robot direction in clockwise or counter clockwise until highest radioactive dose rate was measured at the middle detector and a robot would move forward to radioactive hotspot. However, the radiation count rates were very low due to the small effective diameter of the detectors result a robot required long detection time to accumulate radioactive doses before moving forward or changing direction. Thus, a robot is suitable to apply for surveying and indicating high radioactive dose rate from radioactive hotspot.





Improving the Internal Secondary Standards for Stable Isotope Measurement of Tritium by using Vacuum Distillation Method

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VSMOW (Vienna Standard Mean Ocean Water) is the reference standard material for stable isotopes of water sample analysis. The VSMOW prepared by Section of Isotope Hydrology, The International Atomic Energy Agency (IAEA). This reference standard for analysis H and O ratios δ H-3. Which the preparation of gwater must be clean and high quality as representative for human to use as drinking water, shower, transportation etc. The price of VSMOW the reference standard is very high and limited to order. The main purposed of this work, the internal secondary standards for stable isotope tritium measurement by using Vacuum distillation method. The preparation of 27 secondary standard samples from deionized water for 30, 40, 50°C on vacuum distillation and samples volume of 250, 500, 750 ml and counting samples from Picarro isotopic water system L2130-i Analyzer and calibration samples with VSMOW. Results of the measurement of δ H-3 samples were (-91.89), (-83.09) and (-69.83) respectively. It can concluded that this method can be the internal standard for stable isotope tritium replace the VSMOW.

Keyword: VSMOW, Isotope Hydrology, IAEA, deionized water, vacuum distillation, Picarro isotopic water system L2130-i Analyzer





Effect of fruit juice to reduce chromosome damage in gamma-irradiated human lymphocytes

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This study determined the antioxidant activities and radioprotective effect of Thai fruits juice extracts of *Aeglemarmelos* or Bael and *ClitoriaternateaL.* or Pea. The antioxidant activities of these extracts were tested using DPPH assay, ABTS assay and FRAP assay. Total phenolic content was determined using Folin-Ciocalteu assay. Radioprotective effect of fruit juice extract was determined using micronucleus assay. The results showed that Bael exhibited strongest antioxidant activity with the EC_{50} of 233.58 $\mu\text{g/ml}$, (EC_{50} of Pea was 754.17 $\mu\text{g/ml}$). ABTS of Bael and Pea were 1463.68 and 1132.38, respectively. FRAP value of Bael and Pea were 1567 mM and 349.5 mM, respectively. Score of micronucleus reduce about 30% and 57 % at concentration of 50 & 100 $\mu\text{g/ml}$ of Bael, respectively.

These Thai fruit juice from *Aeglemarmelos* extracts are potentially of antioxidant activities, and able to promoted for radioprotective agent.

Keywords: Antioxidant activity, *Aeglemarmelos*, *Clitoriaternatea L.* Micronucleus, radioprotective agent





Dose Measurement of Radioactive Wastes in form of spent ion-exchange Resins

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Ion-exchange resins are used for purification of radioactive waste waters in the Thai Research Reactor-1/Modification 1 (TRIGA MARK III) of Thailand Institute of Nuclear Technology (Public Organization). The total generating capacity of the research reactor is 2 MW with 500 tons and 800 tons force cooling systems. The uniform particle size separable mixed bead ion exchange resins are used for production of ultra-pure water, called Dowex monosphere MR-3UPW. The functional groups of the resin beads are sulfonic acid and quaternary ammonium. The maximum operating temperature is 60 °C. Normally, the resins are used to remove radionuclides and other impurities from cooling water for one year. Thus, the spent resins will be a radioactive waste because they are contaminated with radioactive materials. The contaminated resins have been kept in plastic and steel containers for long term storage or disposal. In this project, the total radiation dose of the spent ion-exchange resins were evaluated by themoluminescent dosimetry (TLD) and the radioisotopes were identified by gamma spectrometry. The spent resins were loaded to seven plastic containers, dimension $33 \times 38 \times 58 \text{ cm}^3$. In each container, it had been loaded $\sim 30 \text{ kg}$ of the used resins. In addition, the resins were put to seven steel drums, and the size was 200 liters. The weight of the resins in each drum was 80 kg. And the used resins were contained in 12 plastic gallons, diameter $13.5 \times 18.5 \times 28.5 \text{ cm}^3$. The weight of the resins in the gallons was three kg. The nine TLD cards were used to evaluate radiation dose in a single container. The distance between a TLD card and each other was 20 cm to cover the whole container. The evaluation time of radiation dose was 3, 7, and 15 days. The average dose of 50 liter plastic containers was $1.22 \pm 0.09 \text{ mGy}$ for 3 days of evaluation, meanwhile for 15 days of evaluation; the dose was $370 \pm 30 \text{ mGy}$. The mean absorbed dose was $38 \pm 7 \text{ mGy}$ in case of steel containers and the dose of plastic gallons was $6 \pm 2 \text{ mGy}$ for 7 days of evaluation. The results shown that the radiation dose of spent ion-exchange resins depend on the containers and amount of the resins in these containers. The radioisotopes were analyzed by gamma spectrophotometry with a high purity germanium detector. The spent resins were composed of radioisotopes such as Co-67, Se-75, I-131, Cr-51, La-140, Cd-115, Kr-85, Sb-122, Y-88, Sb-124, Mn-54, Zn-65, Co-60, Cs-137, Cs-134 and Na-24. However, for long term storage, the radioisotopes that could be measured in the spent resins were Cs-137, Sr-85, Mn-54, Y-88, Zn-65 and Co-60 because of the short half life radioisotopes. The total average radiation absorbed dose of the spent ion-exchange resins for one year was $8.9 \pm 3.3 \text{ Gy}$.

Keywords: Themoluminescent dosimetry, Resin, Gamma spectrophotometry





The ability to radiation protection and antioxidant capacities in Homnil Rice, Riceberry and Muser Purple Rice, which contain anthocyanin and polyphenolic

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Rice is the most important cereal in the nutrition and calories receiving of human. The rice is the main food of the Thai people. By each type of rice is useful and it has different properties. Objective : this study was to the ability radiation protection and antioxidants capacities in Homnil Rice, Riceberry and Muser Purple Rice, which contain anthocyanin and polyphenolic in high quantity. Methods: study effect of extract from three ricetype in *in vitro* studies of antioxidative effect of three fractions were investigated using DPPH, ABTS and FRAP assay and study of radioprotective effect from rice extracted was using micronucleus assay. Results and conclusion: Muser Purple Rice has the highest antioxidants capacities of extract from three rice type. DPPH assay, EC50 was 90 $\mu\text{g/ml}$, ABTS assay was 916.13 $\mu\text{g/ml}$ and FRAP assay was 1862 $\mu\text{g/ml}$. Result of Radioprotective effect by micronucleus assay. It was found that Muser Purple Rice are reduce Micronucleus about 40% and 60% at concentration of 50 and 100 $\mu\text{g/ml}$, respectively. Therefore, Muser Purple Rice is suitable for radioprotective agent.

Keywords: HomnilRice, Riceberry, Muser Purple Rice, Anthocyanin and Radioprotective agent.





Evaluation of the antigenotoxic potential of Thai vegetables in human lymphocytes

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The purpose of this research were to study antioxidants of 2 types of Thai vegetables; *Tiliacora triandra* (*Colebr.*) *Diels* or Bamboo grass and *Centella asiatica Urban* or Tiger Herbal. These extracts were determined for antioxidant activity by the 2,2-diphenylpicrylhydrazyl (DPPH assay), 2,2'-azino-bis (3-ethylbenzthiazoline-6-sulphonic acid) (ABTS assay), Ferric reducing ability (FRAP assay), total phenolic compounds and genotoxicity test was using micronucleus assay. Micronucleus are results from DNA damage. This study had been to irradiate human lymphocyte by 3 Gray of Co-60. For antioxidant activity. The extract of *T. triandra* exhibited strong antioxidant activity with the efficiency concentrate (EC_{50}) of 110 $\mu\text{g/ml}$ and *Centella asiatica Urban* with the EC_{50} of 320 $\mu\text{g/ml}$ for DPPH assay. The extract of *T. triandra* illustrated strong antioxidant activity with the ABTS value of 916.13 $\mu\text{g/ml}$ and value of 716.13 $\mu\text{g/ml}$ for *Centella asiatica Urban*. The extract of *T. triandra* illustrated strong antioxidant activity with the FRAP value of 2882 $\mu\text{g/ml}$ and value of 454.5 $\mu\text{g/ml}$ for *Centella asiatica Urban* and total phenolic compounds of *T. triandra* was 346.88 $\mu\text{g/ml}$ and *Centella asiatica Urban* was 175.44 $\mu\text{g/ml}$. By using Gallic acid as reference standard. For micronucleus assay; various concentrate of *T. triandra* of were mixed in the human lymphocyte which irradiated at 3 Gray of Co-60. From result showed that *T. triandra* can be reduce micronucleus about 50% and 75% at 50 $\mu\text{g/ml}$ and 100 $\mu\text{g/ml}$, respectively. The effect of *T. triandra* had strong antioxidant and able to improved of make product to eat for health in the future.

Keywords: Antioxidant capacities, Micronucleus assay, DPPH assay, ABTS assay, FRAP assay





Studies on Effects of Crude Extract of *Vernonia cineria* on Blood Glucose and Food Intake in Streptozotocin-induced Diabetes Rats

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The objective of this study was to investigate the effect of crude extract of *Vernonia cineria* on blood glucose, body weight and food intake in streptozotocin induced diabetic rats. Thirty Sprague *Dawley* rats were divided into 5 groups: 1) control group, 2) diabetic group, 3) diabetic group received metformin 150 mg/kg, 4) diabetic group received the extract 10 mg/kg and 5) diabetic group received the extract 40 mg/kg for 30 days. Blood glucose was evaluated once a week, food intake and body weight were weight daily. The results showed that blood glucose levels were significantly different between diabetes induce rats and control groups whereas blood glucose levels in diabetes group received the extract 10 and 40 mg/kg were lower than diabetic group but were not significantly different. Increasing body weight of diabetic group received the extract 10 and 40 mg/kg that were not statistically significant compared with control group and food intake of diabetic group received the extract 10 and 40 mg/kg were not statistically significant compared with another diabetic group. In conclusion, the crude extract of *V.cinaria* could not reduce blood glucose and food intake whereas it has the effect to increase the body weight in diabetes- induce rats

Keywords: diabetes mellitus, body weight, food intake, *Vernonia cineria*





The immune response of hemocytes in *Achatina fulica* after *Staphylococcus aureus* infection

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Giant African snail (*Achatina fulica*) is an alien species animal spreading all over Thailand due to high rate reproduction and plant consumption. Therefore, giant African snail has been recognized as the very harmful agricultural pest. Since the snails tend to eat and move on the ground where several microorganisms are exist, the effective immune system is crucial. Snail mucus can assist in moving forward and defense against microorganisms that are potentially cause contaminant and irritation where as hemocytes and hemolymph substances will defense against infectious pathogens.

To stimulate the snail cell-mediated immunity, bacteria *Staphylococcus aureus* challenging was performed. In the experiments, the snails were divided into three groups of five snails per group (a control group with distilled water injection and two experimental groups with alive and dead bacterial injections). The hemolymph samples were withdrawn from the pedal blood sinus of each snail for protein analysis before injection and after bacterial challenging at six time points (1/2, 1, 2, 8, 16 and 24 hours).

Two types of hemocytes were identified i.e. astero-granulocytes (AGC) and round hyalinocyte (RHC). Percentage of AGC is about 50% before bacterial infection and slightly increased after the first hour of bacterial challenging. During 2-16 hours after bacterial challenging, the AGC was decreased while the RHC was rising up. Within 24 hours after bacterial challenging, the hemolymph profile seems to recover itself and return to the normal stage again.





Effect of *Tiliacora triandra* leaf extract on mice hippocampal cholinergic neuron

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Transient cerebral ischemia is one of the major causes of cognitive decline which was found in dementia patient. It associated with the decrease of neurotransmitter that important to the cognitive abilities especially the cholinergic system. The present study aimed to evaluate the effect of *Tiliacora triandra* leaves extract on the hippocampal cholinergic in normal and transient cerebral ischemic mice.

Transient cerebral ischemia (t2VO) was induced by 3 minutes bilateral common carotid artery occlusion. Thirty male ICR mice were randomly divided into 6 groups of SHAM+VEH, SHAM+300, SHAM+600, t2VO+VEH, t2VO+300, t2VO+600. Twenty four hours after surgery, mice were orally administered with vehicle (10% Tween 80) and/or *T. triandra* extract (300 and 600 mg/kg) for 18 consecutive days. Cholinergic density were analyzed by using the cholineacetyltransferase (ChAT) immunohistochemistry.

The result showed that the hippocampal ChAT density was increased in SHAM+300 and significantly increased in SHAM+600 without significant difference in transient ischemic groups. The present study concluded that *T.triandra* leaves extract enhance cholinergic function in normal mice but not transient cerebral ischemic mice.





Habitat use of Forest-crested Lizard *Calotes emma* (Schmidt, 1925) in Sakaerat Environmental Research Station, Nakhon Ratchasima Province

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The Forest-crested lizard, *Calotes emma* is a forest species which is widely distributed from India, Myanmar, South of China, Thailand and Malaysia. This species is reported for its occurrence in the dry dipterocarp forest in the Sakaerat Environmental Research Station, Nakhon Ratchasima Province. The study aimed to investigate habitat use of *C. emma* at night time to better understand the ecological requirement of *C. emma*. The surveys were carried out for two consecutive nights between June and August 2014. The visual encounter surveys were conducted for three 200 m line transects at 1900 - 2300 hrs. All captured individuals were marked for monitoring the habitat use.

The results showed that 21 individuals were captured, consisting of 16 males (SVL = 78.50 ± 3.08) and 5 females (SVL = 80.13 ± 2.23). The body size did not differ between sexes. The habitat parameters are height above ground, girth, and angle of substrate types. The results indicated that the Forest-crested lizard used various kinds of microhabitat. The frequency of microhabitat use was small twigs (36.36%) tree trunk (22.73%), base of the tree (9.09%), vines (4.54%), leaves (9.09%) and dry twigs (18.18%). The angle of substrate used was between 8.88 to 88.80 degree, and the average height was 123.72 cm above the ground for males and 90.63 cm for females. The Forest-crested lizard was found in the areas with moderate tree canopy covered and the ground covered with leaves was quite dense (> 80%).

In conclusion, the results of the study indicated the preference of habitat use of *Calotes emma* which could be applied for ecological management of this species in the future.





Effect of Crude Extract of *Vernonia cinerea* on Semen Quality in Streptozotocin-induced Diabetes Male Rats

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Nowadays, natural medicines are interested to use as modern medicine because its help to reduce chemical use and can cure disease similar with modern medicine. *Vernonia cinerea* has been used as Thai traditional medicine, it has benefit to treat many disease such as diabetes mellitus. The aim of the present study was to investigate the effects of crude extract of *V. cinerea* on streptozotocin-induced diabetes mellitus male rats. Thirty Sprague dawley male rats were divided into 5 groups; Group 1: normal rats (Control) and streptozotocin-induced diabetes mellitus rats (STZ) 4 groups; Group 2: STZ treated with distil water, Group 3: STZ treated with crude extract *V. cinerea* 10 mg/kg, Group 4: STZ treated with crude extract *V. cinerea* 40 mg/kg and Group 5: STZ treated with Metformin 150 mg/kg. All animals were treated daily for 30 days. The caudal epididymides were collected for analyses sperm concentration, percentage of sperm motility, percentage of sperm viability and percentage of sperm abnormality. The results show that there were no significant differences in sperm concentration between STZ treated with crude extract *V. cinerea* 40 mg/kg and control group, whereas there were significantly higher than other STZ rats. The percentage of sperm motility and percentage of viability sperm in STZ rats were significantly less than control group but the percentage of sperm abnormality in STZ rats were higher than control group. The present study indicates that crude extract of *V. cinerea* 40 mg/kg improve the sperm concentration in streptozotocin-induced diabetes mellitus male rats.

Keyword: Diabetes mellitus, Streptozotocin, *Vernonia cinerea*, Semen quality, Natural medicine, Erectile dysfunction





Neuroprotective effect of *Tiliacora triandra* against cerebral ischemic reperfusion injury in mice

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The present study aimed to evaluate neuroprotective effect of *Tiliacora triandra* (Colebr.) Diels leaves extract against ischemic-reperfusion injury in mice.

Twenty-male ICR mice were randomly divided into 4 groups of BCCAO + 10% Tween 80, BCCAO + *T.triandra* 300 mg./kg. , BCCAO + *T.triandra* 600 mg./kg., BCCAO + Quercetin 10 mg./kg. The global cerebral ischemic reperfusion (BCCAO) was induced by 30 minute-bilateral common carotid artery occlusion followed by 45 minutes of reperfusion. At the end of reperfusion period, the histopathological changes in cerebral cortex and hippocampus were evaluated.

Results showed that pretreatment with *T.triandra* leave extract 300 and 600 mg/kg for 15 consecutive days significantly attenuated the percentage of neuronal dead in the hippocampus. The result of the present study conclude the neuroprotective effect of *T. triandra* leave extract against brain ischemicreperfusion injury in mice.





The diversity study of marine mollusk in Mook Island, Trang Province

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This study focuses on the diversity of sea mollusk shells, particular the gastropods and bivalves that found in 6 subhabitats of Mook Island, Trang Province. Random sampling by hand picking was used for collecting epifaunal and arboreal mollusks whereas digging 10 cm depth for collect infaunal species. A total of 108 species from 48 families, divided to 70 species, 30 families of gastropods and 38 species, 18 families of bivalves were recorded from this study. Sandy beaches was the most diversity habitat of mollusks species (33 species), 24 gastropods and 9 bivalves were found. Following 31 species of 15 gastropods and 16 bivalves were recorded at Seagrass. Also, 30 species of 21 gastropods and 9 species of bivalves were recorded at rocky beach. Mangrove, shallow coral and rocky shore show low mollusk species, 20 species 18 species and 14 species respectively. The *Nassarius Snail*, *Nassarius pullus* (Linnaeus, 1758) was the most common species that found in almost habitat except rocky shore. Family Muricidae was the most important group in rocky beach and sandy beach that showed 6 and 3 species respectively. Family Trochidae and Family Neritidae found maximum by 2 species of each at rocky shore. Bivalve from Family Veneridae, found the highest diversity from seagrass and mangrove habitat, 6 and 5 species were recorded. Pearl shell from family Pteriidae was maximum at fringe shallow coral, 4 species were found. Although the recorded of mollusk in this study was similar to previous study along coastal of Andaman sea however 39 new recorded of Thailand was the interesting occurred. Also this study will be the basic information of diversity to conserve and tourism development in Mook Island.





Acute Toxicity of Atrazine Herbicide to Glochidia of Freshwater Pearl Mussel *Hyriopsisbialata* Simpson, 1900

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Atrazine is a widely used herbicide in Thailand. The aim of this study was to investigate acute toxicity of commercial atrazine formulation (90% w/w active ingredient) to glochidia of freshwater pearl mussel (*Hyriopsisbialata* Simpson, 1900) by static bioassay method at the water temperature of 27 °C. The experiment was carried out during December 2014 to February 2015 at Department of Zoology, Faculty of Science, Kasetsart University. Glochidia were exposed to atrazine at concentrations of 40.83, 45.77, 50.34 and 53.06 mg/L for 24 and 48 h. Each concentration had 3 replications. Probit analysis was performed for evaluating the median effective concentration (EC₅₀). The results showed that the 24 and 48 h EC₅₀ with 95% confidential level of atrazine were 49.34 (47.70-51.25) and 45.48 (41.56-48.27) mg/L, respectively. The results indicated that the atrazine residual concentrations in the aquatic environment that have been reported (0.038 mg/L) are lower than the atrazine EC₅₀ values in this study, thus, under those use regimes it may not cause acute toxicity to glochidia.





Expression of immunological proteins in *Achatina fulica* hemolymph after *Staphylococcus aureus* infection

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At present, natural products and extracts from plants, animals, and microorganisms have been popularly used in cosmetic and medical applications, including snail mucus and extract. The purpose of this research is to study expression of proteins in the immune system of the giant African snail (*Achatina fulica*) hemolymph after *Staphylococcus aureus* infection.

In the experiments, the snails were divided into three groups of five snails per group (a control group with distilled water injection and two experimental groups with alive and dead bacterial injections). The hemolymph samples were withdrawn from the pedal blood sinus of each snail for protein analysis before injection and after bacterial challenging at six time points (½, 1, 2, 8, 16 and 24 hours). All hemolymph samples were analyzed with 1D SDS-PAGE to investigate patterns of protein expression in each group at the aforementioned time. The in-gel protein separations will be further analyzed by tandem MS and using bioinformatics tools to identify and predict their functions.

In conclusion, alteration of immunological proteins in the giant African snail hemolymph in response to *S. aureus* infection has been observed within 24 hours. Our developed bacterial challenging methodology can stimulate the immune response within the snail similar to vaccination. This finding will provide alternative use of the pest snails as an optional source for novel antibacterial agent discovery.





Studies on the Effects of Erude Extract of *Vernonia cinerea* on Testicular Structure in Streptozotocin-induced Diabetes Male Rats

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The aim of the present study was to examine the effects of crude extract of *V. cinerea* on testicular structure of streptozotocin-induced diabetes rats. Thirty Sprague-Dawley male rats were randomly divided into five groups: group 1; non-diabetic rats (control group), group 2; diabetic rats (DM), group 3; DM received Metformin 150 mg/kg (DM+Met), group 4; DM received *V. cinerea* extract 10 mg/kg (DM+10) and group 5; DM received *V. cinerea* extract 40 mg/kg (DM+40). All animals were treated daily for 30 consecutive days. After that, the testes and epididymis were collected and weight, the testes were preserved for histological studies. The results show that testicular and epididymal weight of DM+40 group was not significantly different with control group, but there were significantly heavier than other groups ($p < 0.05$). There was no significant in seminiferous tubules diameter and seminiferous tubule lumen diameter between DM+40 and control group whereas there were significantly higher than other groups. These finding, suggest that crude extract of *V. cinerea* 40 mg/kg may improve the testicular structure in streptozotocin-induced diabetes male rats.

Keywords: *Vernonia cinerea*, testicular structure, diabetes mellitus, testis, seminiferous tubules, spermatogonia





Hemotoxic effects of atrazine on the freshwater mussel, *Hyriopsis bialata* Simpson, 1900

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Atrazine is a herbicide widely used in Thailand to control broadleaf weed species that grow in crops such as corn, sugarcane, and pineapple. High utilization of atrazine results in its contamination both in terrestrial and aquatic environments. Bivalve molluscs ubiquitously distribute in several aquatic environments. Their filter-feeding activity likely makes them sensitive to toxicants, and thus they are often used as sentinels to monitor the toxic levels in the water. In the present study, we evaluate the toxicity of atrazine to the hematology of the freshwater mussel, *Hyriopsis bialata*. The mussels were treated with environmentally-relevant concentrations of atrazine (0, 0.016, 0.16, and 1.6 mg/l). Hemolymph was collected from the anterior adductor muscle and mixed with Alsever's solution on day 0, 4, 7, 14, 21, and 28. Hemocyte density was determined using hemocytometer. Hemocyte morphology was examined by differential staining and viability of the cells was assessed by trypan blue exclusion assay. It appears that atrazine induces death and decreased density of hemocytes in a dose dependent manner, while the distribution of hemocyte types is not different among treated and control groups. Notably, mussels exposed to atrazine at 1.6 mg/l died within 4 day after the treatment. The results from the study provide fundamental knowledge on hemotoxicity of atrazine to the Thai freshwater mussel, *H. bialata*, and probably to other related freshwater mussel species.





Short-term effect of right common carotid artery occlusion on the dorsal hippocampal neuron

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Chronic cerebral hypoperfusion associated with cognitive decline was gradually intensified due to the intensity and duration of hypoperfusion as well as the degree of neuronal dead. This study investigated the short-term effect of mild chronic cerebral hypoperfusion caused by permanent right common carotid artery occlusion on the dorsal hippocampal neurons.

Eighteen-male Sprague-Dawley rats were randomly divided into 2 groups of Sham and UCO. Each group was further divided into a subgroup based on the period of occlusion (2, 4 and 8 weeks). Histopathological analysis of the hippocampus was studied by using Cresyl violet and Luxol fast blue staining.

The results indicated progressively decrease viable neurons in contrast with damaged neurons in the dorsal hippocampus. Comparison between UCO and Sham indicated significance increase of percentage of damaged neurons in CA1 region at 8 weeks after permanent right common carotid artery occlusion. The present study concluded that mild chronic cerebral hypoperfusion induced by permanent right common carotid artery occlusion induced significance CA1 damage within 8 weeks.





The Effect of *Tiliacora triandra* Leave Extract on Changes in Blood Glucose Levels and Hepatic Catalase in Streptozotocin-Nicotinamide-Induced Diabetic Rats

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The objectives of this study were to investigate the effect of *Tiliacora triandra* leave extract on changes in blood glucose levels and hepatic catalase in streptozotocin nicotinamide-induced diabetic rats. Rats were induced to be type 2 diabetes with single dose of 120 mg/kg body weight of nicotinamide and followed by 60 mg/kg body weight of streptozotocin via peritoneal route. The rats with the fasting blood glucose levels above 126 mg/dl were classified as diabetic rats which were allocated into four groups as following: group I, non-diabetic rats given Tween-80 as a control; group II, diabetic rats provided Tween-80; group III, diabetic rats given *Tiliacora triandra* leave extract at a dose of 300 mg/kg body weight; and group IV, diabetic rats given 250 mg/kg body weight of metformin. All rats were daily administrated via esophageal route for 5 weeks. The blood was weekly withdrawn via tail tip clipping for blood glucose determination. At the end of this experiment, liver was excised to monitor catalase, can be followed by measuring the absorbance at 240 nm. It was found that the extracts (group III) could significantly decrease the blood glucose and significantly increase hepatic catalase as compared to the diabetic rats (group II) at the end of this experiment ($p = 0.006$, $p = 0.024$, respectively).





Preliminary Study for Uses of Screen-printed Electrode (SPE) on a Total Sulfur Determination in Gasoline

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Sulfur in gasoline causes erosion in automotive engines and, consequently, an environmental pollution. The EURO4 regulation that currently applies on Thai gasoline allows the sulfur content not more than 50 ppm. With this low allowance, high sensitive measurement method is required. Square-Wave Voltammetric technique is one of sensitive methods, often employed for low concentration determination. However, the electrodes treatment and setup in the voltammetric cell are quite complicate. Therefore, this study aims to present a possibility of applying compact-design electrodes called screen-printed electrode (SPE) which was developed mainly for aqueous measurement, onto a total sulfur determination in gasoline medium.

Due to the material made of SPE that soluble in gasoline medium and its large working electrode size at fixed 3-mm diameter, many measurement conditions such as solvent type, electrolyte concentration and optimized pH for the total sulfur determination were investigated. The results reveal that a 98:2 methanol: acetic acid solvent suited for the SPE material. Unfortunately, with the large, 3-mm diameter, size of SPE, no sulfur signal was detected. The measuring pH and concentration of CH_3COONa electrolyte were, then, varied. The results in term of sensitivity were demonstrated in comparing with the signals obtained from an ultramicro-electrode, under each same condition. It was, finally, found that the 3-mm diameter gold electrode could be used to measure the total sulfur in gasoline medium when 1.5 M CH_3COONa was applied at pH 6. The measurement sensitivity of 0.2 mA/ppm was obtained from the 3-mm-diameter gold electrode while 0.4 nA/ppm was obtained from the 40- μm -diameter gold electrode. A linear range of 0.02-1.00 ppm was achieved on both size electrodes with R^2 larger than 0.996.

Keywords: Total sulfur, Gasoline, Voltammetry





Development of Portable Spectrophotometric Device with Flow-based Analysis System for Detection of Heavy Metal Ions

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Lead (II) and cadmium (II) were determined by a flow-based analysis with spectrophotometric detection. Quercetin (Querc) and cetyltrimethylammonium bromide (CTAB) were used as a complexing agent and surfactant, respectively. The absorbance of the yellow-colored complexes (Pb-Querc and Cd-Querc) were measured in Tris (hydroxymethyl) aminomethane buffer medium (pH 8.9) in the range of 400-420 nm. The linear relationship between absorbance and concentration of metals were obtained over the concentration range from 0.2-1.0 mg/L for Pb (II) and Cd (II) determination. The limit of detection (LOD, defined as 3SD) of Pb (II) was 0.0144 mg/L and the limit of quantification (LOQ, defined as 10SD) was 0.0480 mg/L. The limit of detection (LOD, defined as 3SD) of Cd (II) was 0.0190 mg/L and the limit of quantification (LOQ, defined as 10SD) was 0.0633 mg/L. The relative standard deviation were 2.09% (n=10) and 3.29% (n=10) for 0.5 mg/L Pb (II) and Cd (II) respectively. The developed method was applied with a cost-effective spectrophotometer for the determination of Pb (II) and Cd (II) in water. The LED (light-emitting diode) was used as an alternative light source for miniaturization purposes.

Keywords: Heavy metal, light-emitting diode, Flow injection spectrophotometer





Determination of Pesticide, Organophosphate and Carbamate, on Commercial Vegetable

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Organophosphate and carbamate have been used as pesticides in vegetables around Thailand since they are cheap, high insecticide efficiency and widely sold around the farm area. Organophosphate and carbamate is inhibitor of acetylcholinesterase, an enzyme critical to the control of nerve impulse transmission from one cell to another. When the enzyme is inhibited, there is overstimulation and then paralysis of the secondary cell. LD₅₀ of organophosphate and carbamate is at 5 – 500 mg/kg. In these study, 10 kinds of vegetable such parsley, chinese kale, cabbage, chinese cabbage, water morning glory, carrot, lettuce, cowpea, tomato, cucumber were tested by GT-Test Kit. The vegetables were purchased and tested on May, July, and August of the year 2014. Vegetables were sampling from four target markets, one supermarket and pesticide residue free vegetables were sampling from healthy grocery store. The study found the contaminated of organophosphate and carbamate in cucumber, chinese kale and parsley were over the maximum residue limits (MRLs) issue by Thai Food and Drug Administration, issue number 288(B.E.2548) on every month. It could be indicated that dry season found the highest number of samples which contain pesticide.

