



PROMOTING ECOTOURISM THROUGH INNOVATION
AND DEVELOPMENT IN NATURAL PRODUCTS

The Regional Conference and Exhibition of Natural Products, Traditional Medicines and Herbs

*Promoting Ecotourism Through Innovations and Developments
in Natural Products*

9 - 11 December 2021

Borneo Convention Centre Kuching (BCKK) | Zoom (Hybrid)

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Introduction

This conference aims to bring together researchers, academicians and entrepreneurs in all areas and related fields of natural products, traditional medicines and herbs to share their research findings. It also serves as a platform to showcase the innovation and application of natural products, fostering interdisciplinary collaborations and identifying potential opportunities.

You can join the conference to present a paper orally or through posters. Alternatively, you can exhibit your products or submit a video of 2 minutes.

Scopes:

- Pharmacology (pharmacological activity, efficacy, interactions)
- Biochemistry (Biosynthesis, ethnopharmacology, ethnomedicines)
- Chemistry (Phytochemical analysis, biomarker identification, toxicological evaluation)
- Ethnobotany (Drug discovery)
- Quality Control and Quality Assurance
- Application & Product Development (Medical, biomedical, pharmaceutical, food, cosmetics, skincare)
- Sustainable Management of Natural Products (Production, development, environmental impacts and risk assessment)
- Socioeconomic and Demography (demographic analysis of natural product consumers)
- Sustainable Community-Based Natural Products
- Natural Products & Tourism

All selected papers will be peer reviewed and published in the following journals:

- The International Journal of Phytomedicines and Related Industries (SCOPUS)
- Borneo Journal of Resource Science and Technology (SCOPUS)
- Journal of Smart Science and Technology

Opening Ceremony

9th December 2021

Time	Agenda
0800-0845	Arrival of participants. Registration and Conference kits collection.
0845	Arrival of VVIP <ul style="list-style-type: none">• MR HII CHANG KEE, Setiausaha Tetap, Kementerian Pelancongan, Kesenian dan Kebudayaan Sarawak• MS AMELIA ROZIMAN, Chief Executive Officer, Business Sarawak Events• DATU HAJI HASHIM BIN HAJI BOJET, Pemegang Amanah Kursi Tun Zaidi/Pengurus Besar, Sarawak Timber Industry Development Corporation• PROFESSOR DATUK DR MOHAMAD KADIM BIN SUAIDI, Vice Chancellor, Universiti Malaysia Sarawak (UNIMAS)
0855	Arrival of Guest of Honor - YB DATO SRI HAJI ABDUL KARIM RAHMAN HAMZAH , Menteri Pelancongan, Kesenian dan Kebudayaan Sarawak
0900	Negaraku Ibu Pertiwiku
0905	Doa Recital
0910 – 0920	Welcoming Remark by the Vice Chancellor UNIMAS
0920 – 0945	Speech by the Guest of Honor
0945 – 0955	Launching of “Wonders of Natural Products in Malaysia” & Opening Ceremony & Souvenir Presentation
0955 – 1000	Photo session
1000	Refreshment

Conference Programme

Day 1: 9th December 2021

Time	Programme
0900 – 1000	Opening Ceremony
1000 – 1030	Refreshment
	Session Chair: PROF. DR. EDMUND SIM UI HANG
1030 – 1115	Plenary Session 1 <i>“Innovations, Trends and Challenges in Development of Natural Products, Traditional Medicines and Herbs”</i> PROF. DR. JAMIA AZDINA BINTI JAMAL
1115 – 1200	Plenary Session 2 <i>“Commodification Of Rurality In Sustainable Ecotourism Products”</i> ASSOC. PROF. DR. AMNAJ KHAOKHRUEAMUANG
1200 – 1330	Lunch
	Session Chair: PROF. DR. AWANG AHMAD SALLEHIN AWANG HUSAINI
1330 – 1400	Invited speaker 1 <i>Utilisation Of Natural Resources Through Documentation, Discovery And Development Of Natural Product Entities – The Frim Experience</i> DR. LING SUI KONG (FRIM)
1400 – 1430	Invited speaker 2 <i>New Frontier to Treat Smoking Addiction with Painless Laser Acupuncture.</i> MR. RODNEY LIM (Laser Acupuncture Centre, Singapore)
1430 – 1500	Invited speaker 3 <i>Introduction to Acupuncture Research: History and its Practice.</i> PROF. DR. ZHOU WEN XIN (International Medical University)
1500 – 1530	Invited speaker 4 <i>Perspective of Traditional Chinese Medicine</i> DR. GAN MING HANG (SOUTHERN UNIVERSITY COLLEGE)
	Session Chair: PN AMIRA SATIRAWATY
1530 – 1550	<i>Entomopathogenic Fungi As Potential Source For Laccase Enzyme</i> NUR ATHIRAH BT AZIZ
1610 – 1630	<i>Production And Extraction Of Phenolic Compounds From Fermented Raw Sago Starch By Selected Fungal Endophytes</i> NURUL AIDA QARINA BT MOHD RAZALI
1630 – 1700	Refreshment

Conference Programme

Day 2: 10th December 2021

Time	Programme
	Session Chair: DR FREDDY YEO
0900 – 1000	<i>Consumer Preferences On Herbs And Spices In Sarawak, Malaysia</i> NURUL SYAHIRAH MANSUR
	<i>Phytotherapeutic Approaches For Management Of Hyperuricemia In Gout</i> DR. PREKAN ANUSAKUMAR
	<i>Identification Of Neuroprotective And Anti-Neuroinflammation Agents Against Lps-Induced Microglial Cells Within Butterfly Pea Via Molecular Networks</i> DR. SITI MUNIRAH MOHD FAUDZI
	<i>Unlocking Untapped Resources From Elaeis Guineensis Leaf As Therapeutic Agents In Regenerative Medicine</i> DR. MOHAMAD SHAZELI CHE ZAIN
	<i>Styryllactones And Alkaloids From Goniothalamus Lanceolatus Miq.</i> DR. NUR VICKY BIHUD
	<i>Development Of Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) Method For Determination Of Trace Metals In Black Pepper Berries</i> DYG SYAFIZNUR AISYAH ABANG YA'KUB
	<i>Phytochemical Screening Of Saffron Ethanolic Extract: A Preliminary Report</i> IMAN NABILAH ABD RAHIM
	<i>Fatty Acid Composition And Antimicrobial Activity Of Litsea Garciae Pulp And Seed Extracts</i> LING ZINYIN
	<i>Assessment of the Antibacterial and Antibiofilm Activity of Uncaria tomentosa extracts against Oral Bacteria</i> NOR HASLINI WAHID
	<i>Antihypertensive Effect Of Averrhoa Bilimbi Fruit Extract In Spontaneously Hypertensive Rat</i> DR. NORSYAHIDA MOHD FAUZI
	<i>Industrial, Biological And Pharmacological Uses Of Shorea Macrophylla L.</i> AJIBOLA OLAIDE OLUWUNMI
	<i>Antioxidant And Antimicrobial Properties Of Bioactive Compounds Produced Under Solid-State Fermentation Of Sago Pith Waste By Endophytic Fungi</i> CAROLYNNA BUYAU ANAK JAMES
	<i>Malay Ethnobotany And Ethnomedicine In Taj Al-Muluk, A Traditional Malay Medical Text</i> ASSOC. PROF. DR. MOHD AFFENDI BIN MOHD SHAFRI
	<i>Formulation Of Anti Acne Soap And Anti Acne Cream Using Fermented Curcuma Caesia Extract Supernatant</i> DR SITI FATHIMAH PUTERY BINTI JEMAIN
<i>Bioactivities, Phenolic And Carotene Of Aurantiochytrium Sw1 Sp. Harvested With Different Flocculant</i> NURDIANA MOKHTAR	
<i>Potential Therapeutic Application Of Phytomedicines For Sars-Cov-2 Infection: Case Report And Review</i> DR DHANASHREE PRAJAPATI	
<i>Traditional Knowledge Documentation and Useful Plants: Case Studies in Sarawak</i> JOVITA ELDERSON RIPEN	

1000 – 1030	Refereshment
	Session Chair: ASSOC. PROF. DR HASMAH MOHIDIN (UITM)
1030 – 1100	Industry Talk 1 <i>Preserving Sarawak Indigenous and Heirloom Rice</i> MR BRENDAN KON (ANTARES VENTURE SDN BHD)
1100 – 1130	Industry Talk 2 <i>The Virgin Coconut Emulsion (VCE) vs Virgin Coconut Oil (VCO)</i> DR MOHD RAZIP ASARUDDIN (UNIVERSITI MALAYSIA SARAWAK)
1130 – 1200	Industry Talk 3 <i>Black Soldier Fly (Hermetia Illucens) – Effective Food Waste Decomposer</i> MS TAN PEI CHIN (FLY TECHNOLOGY AGRICULTURE SDN BHD)
1200 – 1230	Industry Talk 4 MS AMELIA LIM WEN CHING (AQUAVERMIPONIC SDN BHD)
1230 – 1430	Lunch
	Session Chair: DR WEE BOON SIONG
1430 – 1500	Industry Talk 5 <i>Quality of Sarawak Stingless Bee (Kelulut) Honey</i> DR MARGARET ABAT (AGRICULTURE RESEARCH CENTRE)
1500 – 1530	Industry Talk 6 <i>Authentication Of Geographical Growth Origin Of Black Pepper (Piper Nigrum L.) Based On Volatile Organic Compounds Profile Using Headspace Sampler: A Case Study For Malaysia And Vietnam Black Peppers</i> MR ZEHNDER JARROOP (MPB)
	Session Chair: ASSOC. PROF. DR SIM SIONG FONG
1530 – 1700	Dialogue Session <i>“Potential of Natural Products in Promoting Tourism and Trade”</i> Panelist: EN HII CHANG KEE (Kementerian Pelancongan, Kesenian dan Kebudayaan Sarawak) MR CHEW CHANG GUAN (STATOS)
1630 – 1700	Refreshment

Day 3: 11th December 2021

Time	Programme
0900 - 1600	Visit to ecotourism spots Light & Easy with Sia Sitok 2.0 COORDINATOR: DR. DIANA KERTINI MONIR

INNOVATIONS, TRENDS AND CHALLENGES IN THE DEVELOPMENT OF TRADITIONAL MEDICINES

Jamia Azdina Jamal

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ABSTRACT

The herbal products industry is booming, owing to widespread public interest in the medicinal use of plant-based products in practically all cultures. Plants contain phytochemicals that are necessary for plant growth or are produced as a by-product of the plant's metabolism, as well as possibly beneficial as food or medicine or potentially harmful or poisonous to human consumption or use. Thus, it is vital to subject herbal materials to thorough scientific evaluation in order to assure their quality, safety, and efficacy, and to ensure that genuine herbal products reach customers. As the market for herbal medicines becomes increasingly worldwide, many of the scientific and regulatory challenges associated with research on the quality, safety, and efficacy of herbal medicines remain universal in both developed and developing countries. While herbal medicines have the potential to revolutionise healthcare, numerous significant challenges must be overcome. Modern and innovative applications are required to evaluate the quality, safety, and efficacy of herbal materials and products, as well as to provide scientific justification for their benefit/risk analysis and regulatory approval. If these concerns are addressed, medicinal plants can be used safely, effectively, and affordably as a form of health treatment.

COMMODIFICATION OF RURALITY IN SUSTAINABLE ECOTOURISM PRODUCTS

Assoc. Prof. Dr. Amnaj Khaokhrueamuang

University of Shizuoka, Japan

ABSTRACT

Ecotourism refers to all nature-based forms of tourism that conserve the environment and culture, sustain the well-being of the local people, and contain educational and interpretation activities in natural areas. It minimizes negative impacts on the natural and socio-cultural environment and generates economic benefits for host communities, generally located in rural areas. Thus, commodifying ecotourism products is based on four elements of rurality. They include rural spaces, rural communities, rural products and services, and rural-related activities. This lecture provides knowledge and ideas for creating natural products through the commodification process of rural areas for ecotourism. The case focuses on farming products, particularly in the tea industry.

Invited Speaker

NEW FRONTIER IN PAINLESS LASER ACUPUNCTURE TO TREAT SMOKING ADDICTION

Rodney Lim Choon Huat

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ABSTRACT

Today, medical sciences are advancing and diseases like the current Covid-19 are also getting “smarter and elusive” with many variants too! However, with the cutting-edge of Laser Technology we have now, the field in medicine has also advanced by leap and bounds. We too could tap this special laser light energy to treat a wide range of diseases in rehab like stroke, chronic pain recovery, sports, metabolic syndrom and smoking addiction etc, where the conventional therapy has limitation. Regrettably, smoking and substances addiction among the young has become an “epidemic” worldwide, and health authorities are finding it hard to meet this challenge. The mainstream Allopathic Therapy like counselling, nicotine pad and chewing gum offer a stop gap solution and eventually many were unable to kick off the habits. They had ‘graduated’ into heavy stuff of substances abuse. Especially, the older smokers, who wanted to quit smoking but the dependency, ‘cold-turkey’ cravings, and withdrawals had put them off. This report was a collation of experiences and feedback from group of patients who had seek treatment at Laser Acupunture Centre, Singapore since 2018. Our approach to tackle these recalcitrant challenges is based on the holistic intervention, by applying the Traditional Chinese Medicine (TCM) Principles in Acupuncture to synergize with Laser Light Energy. Although acupuncture is common practice in China, Europe, USA, and many parts of the world, it is still not popular amongst patients who had needle phobia. Therefore, the use of the ‘selective’ Laser Light Energy, when applied with correct dosages to the acupoints is ideal and make therapy more acceptable to smokers.

Invited Speaker

INTRODUCTION TO ACUPUNCTURE RESEARCH: HISTORY AND ITS PRACTICE

Professor Zhou Wenxin

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ABSTRACT

Acupuncture is a form of traditional Chinese Medicine treatment originated 2500 years ago. WHO recognized it from 1970s and it is now accepted as an important part of Complementary and Alternative Medicine in the world. Research in acupuncture started from China and now also has been granted in other countries, and it seems that there are relatively more studies in acupuncture than other forms of traditional medicine. The talk will introduce you the history and its current practice of research in acupuncture.

Invited Speaker

PERSPECTIVE OF TRADITIONAL CHINESE MEDICINE

Dr Gan Min Hang

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ABSTRACT

Traditional Chinese medicine (TCM) has a long history of thousands of years. It has been spread and applied all over the world. In Malaysia, Traditional Chinese medicine is widely developed and applied in our daily life. However, the understanding of how TCM works is relatively vague. In this talk, we will bring the audience into the perspective of TCM practitioners. We will talk about how Traditional Chinese Medicine and Acupuncture works. Hoping to provide a different view and health concepts to the audience.

Invited Speaker

UTILISATION OF NATURAL RESOURCES THROUGH DOCUMENTATION, DISCOVERY AND DEVELOPMENT OF NATURAL PRODUCT ENTITIES – THE FRIM EXPERIENCE

Ling SK, Nik Musaadah M, Fadzureena J, Zunoliza A, Khoo MGH, Mastura M & Ong BK

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ABSTRACT

The complexity of botanical extracts, awareness of the potential benefits of herbal remedies and preparations, and the growing interest in the use of herbal products present unique challenges that necessitate the application of innovative approaches in the research, development and commercialisation (R, D & C) activities. The Natural Products Division of the Forest Research Institute of Malaysia (FRIM) has set itself the goal of supporting the national bioeconomy agenda by documenting ethno-botanical and traditional knowledge for sustainable development and benefit sharing of natural resources, generating scientific knowledge for sustainable utilisation of natural products in the herbal and pharmaceutical industries, developing standardised extracts, active ingredients and prototypes for quality, safe and effective cosmeceuticals and nutraceuticals as well as developing protocols for quality assurance of raw materials, extracts and products. This paper shares the results of some previous and current work on the documentation of traditional knowledge, research and development of selected species, and challenges to be considered.

Keywords: Natural products, traditional knowledge, bioprospecting, standardisation, quality assurance

PRESERVING SARAWAK INDIGENOUS AND HEIRLOOM RICE

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ABSTRACT

Sarawak, Borneo is well known for its incredible rainforest, culture, flora & fauna, also a home to many tribes and indigenous people whom have been hunting and farming for generations. One of the traditions that have been practiced for generations is paddy planting. Sarawak is blessed with a myriad of authentic indigenous and heirloom rice of different color, aroma, taste and shape which is a staple food for the locals. However, production of Sarawak rice is on the decline due to modernization and urbanization. Many farmers are still living in poverty and the younger generations are not keen in taking up paddy planting. Hence, some of the unique specialty rice in Sarawak may soon in danger of going out of existence.

Brendan Kon is the founder of Antares Ventures Sdn Bhd, a company committed to bringing economic empowerment and sustainability to rural paddy farmers and Sarawak indigenous and heirloom rice industry across Sarawak. By working closely with the local communities, he is determined to preserve the proud paddy planting traditions and varieties of indigenous rice in Sarawak. He believes, through effective collective marketing is the way to open up greater local and export market to drive the industry forward. He is currently marketing his Sarawak rice products under the home brand 'KENYALANG', in Malay word for hornbill, a beautiful bird in Sarawak and also Sarawak state emblem. His vision is to enable Sarawak farmers to prosper while developing the indigenous and heirloom rice industry in Sarawak.

THE VIRGIN COCONUT EMULSION (VCE) VS VIRGIN COCONUT OIL (VCO)

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ABSTRACT

Virgin coconut oil (VCO) was known to exert its potential for cosmetics, drugs and nutraceuticals. Virgin coconut emulsion (VCE) is a new functional food derived from VCO which gave more enhancement towards drug delivery system. From our experiment and molecular docking studies and *in-vitro* biological evaluation, it was shown that VCE which was totally dissolve in water showed excellent physicochemical properties compared to VCO (oil based). In the pharmacophore modelling studies, monolaurin, a compound in VCE, derived from lauric acid of VCO was discovered to display the best binding score in comparison with other ligands when bound to **4pql** (*Staphylococcus aureus*) and **6lu7** (SARS-CoV-2) as the receptor active site with an energy binding affinity of -5.27 and -6.32 kcal/mol, respectively. The study concluded that VCE have great physicochemical properties in terms of solubility, antibacterial and antiviral activity particularly the coronavirus (SARS-CoV-2).

Keywords: VCO, VCE, solubility, antibacterial, antiviral.

QUALITY OF SARAWAK STINGLESS BEE (KELULUT) HONEY

Margaret Abat* and Irna Syairina Sahari

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ABSTRACT

A total of 197 kelulut honeys were analysed for compliance against MS 2683:2017, a quality standard for kelulut honey. The samples are raw and/or minimally processed honey and produced by the *Heterotrigona itama* (*H. itama*) species collected and analysed from 2017 to 2021. The reducing sugars contents of the samples are between 13.56 and 83.02 g/100 g, below the threshold level of 85 g/100 g. Only two samples containing HMF above the 30 mg/kg limits, indicating the freshness of the honey. The concentrations of total phenolic in the samples were between 14.50 and 321 mg GAE/kg, indicating the various anti-oxidant capacity of kelulut honey. The honeys analysed in this study are of certain quality and have great market potential.

Keywords: stingless bee, kelulut, honey, quality, antioxidant

Industry Speaker

BLACK SOLDIER FLY (*HERMETIA ILLUCENS*) – EFFECTIVE FOOD WASTE DECOMPOSER

Tan Pei Chin

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ABSTRACT

Food wastage remained the biggest problem globally. It was reported that about 15,000 tonnes of food waste is produced daily in Malaysia. Improper food waste management will lead to these food wastes being disposed of in landfills, contributing to the greenhouse gases emissions that cause global warming. Black soldier fly larvae (*Hermetia illucens*) from the family of Stratiomyidae (Order: Diptera) is known decomposer of food waste, converting food waste into frass beneficial for composting. Besides that, the larvae can be used as bioprotein as food source for poultry, swiftlet and aquaculture industries. We utilize black soldier fly technology to upcycle food waste into useful products, creating a circular economy in the food supply chain.

Keywords: Food wastage, Black soldier fly, waste management, decomposer, bioprotein

**AUTHENTICATION OF GEOGRAPHICAL GROWTH ORIGIN OF
BLACK PEPPER (*PIPER NIGRUM* L.) BASED ON VOLATILE
ORGANIC COMPOUNDS PROFILE USING HEADSPACE SAMPLER:
A CASE STUDY FOR MALAYSIA AND VIETNAM BLACK PEPPERS**

Zehnder J. A. Merce, Hong Siang Chua, Siaw San Hwang, Peter Mahon, Sing Muk Ng

Malaysian Pepper Board, Kuching, Sarawak.

ABSTRACT

Black pepper is one of the common spices used in foods as a flavouring agent. Their utilization is diversified into more advanced applications such as nutraceutical and aroma therapeutic, as well as other non-food ones, such as pest control in the agriculture sector. In order to meet the industry demand, various countries with a suitable tropical climate have grown black pepper as one of their export commodities. Indirectly, reputation and quality of the black pepper are associated with the growth origin as the soil quality, handling processes, and growing environment will influence the final grade of the black pepper. Geographical origin has become one of the parameters in determining the price of the pepper. In view of this, there is a pressing demand to have a standard to identify the growth origin of black pepper to avoid counterfeit issues with the intention to scope for higher market price. This paper reports an attempt to determine the growth origin of black pepper (*Piper nigrum* L.) based on the volatile organic compound (VOCs) profiles recorded using high resolution gas chromatography mass spectrometry system. In this work, black peppers from two different countries of origin; namely from Malaysia and Vietnam were selected as a case study. A total of 145 of black pepper samples from these two origins were extracted for VOCs using an in-line headspace sampler and the VOC profiles were then subjected to Fold Change Analysis and Principal Component Analysis (PCA). PCA cluster plots showed that Vietnam and Malaysian black pepper can be confidently discriminated by means of unique VOCs present in the pepper samples.

Keywords: black pepper, volatile organic compounds, profile, data analysis, identification

STYRYLLACTONES AND ALKALOIDS FROM *GONIOTHALAMUS LANCEOLATUS* MIQ.

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ABSTRACT

Goniothalamus lanceolatus Miq., an indigenous plant from Sarawak, locally known as *selukai* or *gertimang*, is used by ethnic community as traditional medicine to treat various illnesses such as cancer, fever and skin diseases. Preliminary cytotoxic screening on the crude extracts against lung and colorectal cancer cell lines showed promising results from all plant parts. In view of the interesting ethno-medicinal and biological properties, a detailed phytochemical study was conducted to provide scientific data for this plant. Using current and advanced methodologies, a total of 30 chemical compounds were discovered in the barks and roots of the plant, consisting of alkaloids, styryllactones and acetogenin. Interestingly, the styryllactones possessed an α,β -unsaturated δ -lactone moiety with a 6*S* configuration, and δ -lactone moiety with a 1*S* configuration, which were a rare occurrence from nature, thus most compounds were reported for the first time from the genus *Goniothalamus*. Amongst the new compounds, seven were rare bis-styryllactones and two were alkaloids. Cytotoxicity assessment revealed that several of these compounds were active against human lung and colorectal cancer cell lines in the low micro-molar (mM) range, while sparing the human non-cancerous lung and colorectal cells. Docking studies of the active compounds showed that they were able to bind with EGFR tyrosine kinase and cyclin-dependent kinase 2 through hydrogen bonding interactions with the important amino acids.

Keywords: *Goniothalamus*, *Goniothalamus lanceolatus*, Styryllactones, Alkaloids, Cytotoxicity

IDENTIFICATION OF NEUROPROTECTIVE AND ANTI-NEUROINFLAMMATION AGENTS AGAINST LPS-INDUCED MICROGLIAL CELLS WITHIN BUTTERFLY PEA VIA MOLECULAR NETWORKS

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ABSTRACT

Butterfly pea [*Clitoria ternatea* (CT)], is a traditional Ayurvedic medicinal plant, that has been used for a long time to enhance memory and in management of central nervous system (CNS) disorders. Few research involving CT towards neurodegenerative disorders revealing little information about the specific metabolites that are responsible for its medicinal potential. Thus, the full spectra of the specific active metabolites could be uncovered through the molecular networks (MN) tool. MN is a new approach to drug discovery, built on spectral similarity maps generated from mass fragmentation data. The MN is used to dereplicate, identify and prioritize bioactive metabolites for further targeted isolation. In this present study, all CT extracts including roots (CTR), leaves (CTL) and flowers (CTF), were tested for cytotoxicity and anti-neuroinflammation via Griess and MTT assays using the LPS-induced BV-2 cell line. Results indicated CTF extract possesses notable bioactivities. Further cell-based assays were performed on the fractions of CTF, where ethyl acetate fraction elicited significant neurotoxicity and anti-neuroinflammation properties on the LPS-induced BV-2 cells. Concurrently, the multi-informative MN derived from ethyl acetate fraction of CTF metabolome allowed for the putative identification flavonols as the metabolites responsible for the targeted bioactivities.

Keywords: *Clitoria Ternatea*, Anti-Neuroinflammation, Molecular Networks, Putative Identification, Flavonols.

MALAY ETHNOBOTANY AND ETHNOMEDICINE IN TAJ AL-MULUK, A TRADITIONAL MALAY MEDICAL TEXT

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ABSTRACT

Purpose of study: Ethnobotanical and ethnomedical knowledge of the Malays could be known either through oral sources or written sources which exist as Malay medical manuscripts. The traditional sources of Malay medicine are useful for traditional and modern pharmaceuticals development in Malaysia and for conservation of biodiversity. Methodology: This study aims to extract and analyse the ethnobotany and ethnomedical contents in the medical chapter of Taj al-Muluk, a renowned Malay medical text in Nusantara. Transliteration and data extraction were carried out in order to identify and classify the information in the text. Summary of findings: The findings show that the manuscript contains 291 interventions for 56 different diseases, using more than 200 plant-based materials, 10 animal-based materials and 40 other types of materials. Significance: Many of the names and uses of the materials are now rare or not well-known in today's society. The analysis of the ethnobotany and ethnomedical contents of Taj al-Muluk will be useful to learn how the local Malay population utilised their ethnobotanical and ethnomedical resources, hence preventing the loss of local knowledge and assisting contemporary medical research in finding cures and alternative therapeutics for various diseases.

Keywords: Taj al-Muluk, Malay, traditional medicine, ethnobotany, ethnomedicine.

ANTIHYPERTENSIVE EFFECT OF *AVERRHOA BILIMBI* FRUIT EXTRACT IN SPONTANEOUSLY HYPERTENSIVE RAT

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ABSTRACT

Hypertension is one of the most common diseases contributing to various complications including cardiovascular diseases. *Averrhoa bilimbi* (AB) fruit extract was shown to have an antihypertensive effect. Previous studies reported that AB leaf extract may reduce blood pressure through inhibition of angiotensin converting enzyme inhibitor (ACE) activity. However, whether antihypertensive effect of fruit extract is also mediated through similar pathway is unknown. Therefore, this study was aimed to investigate the effect of AB fruit on blood pressure and ACE activity in spontaneous hypertensive rats (SHR). The phytochemical screening was carried out to identify the presence of alkaloids, triterpenes, steroids, saponins, phenolics and flavonoids. In the in vivo study, rats (n=6) were divided into three groups that include 1) a control group, 2) a treatment group [AB extract (880 mg/ml)] and 3) a positive control group [perindopril (0.36mg/kg)]. Treatment was given orally for two consecutive weeks. Systolic blood pressure (SBP) was determine before and after treatment. At the end of the study, all rats were sacrificed, lung tissue was collected for determination of ACE activity. The phytochemical screening revealed that the methanolic extract contains triterpenes, saponins and flavonoids. The in vivo study showed that AB extract significantly reduce the SBP compared to control group (p<0.05). However, AB extract did not inhibit ACE activity. In conclusion, antihypertensive effect *A. bilimbi* fruit is may not be mediated through inhibition of angiotensin converting enzyme activity.

Keyword: ACE, Averrhoa bilimbi, hypertension

PHYTOCHEMICAL SCREENING OF SAFFRON ETHANOLIC EXTRACT: A PRELIMINARY REPORT

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ABSTRACT

Preliminary phytochemical screening is a valuable step to detect the bioactive compounds present in medicinal plants which could lead to drug discovery and development. Saffron, the dried stigma of the flower of *crocus sativus* L., has been used in traditional medicine to treat several diseases such as cardiovascular diseases, insomnia and dysmenorrhea. In this study, we aimed to determine the phytochemical constituents of the saffron ethanolic extract. Saffron was purchased from Saharkhiz Saffron Co. (Iran) and deposited at the herbarium of Universiti Kebangsaan Malaysia with voucher specimen number ID006/2021. Saffron was extracted using maceration method. The extracts were then subjected for phytochemical analyses which include foam test, alkaline reagent test, marquis test, Salkowski's test, aqueous sodium hydroxide test, lipid test and biuret test to confirm the existence of saponins, flavonoids, alkaloids, terpenoids, glycosides, lipids, and proteins respectively. Saffron ethanolic extract revealed the presence of saponins, flavonoids, alkaloids, terpenoids, glycosides and lipids. Proteins were not present in the extract. The medicinal properties of saffron extract could be contributed by these identified bioactive compounds. Further quantitative analysis of bioactive compound of saffron extract should be conducted so that the medicinal benefits of saffron extract could be fully utilized.

Keywords: phytochemical analysis, saffron, *crocus sativus*, flavonoid, medicinal plants

FATTY ACID COMPOSITION AND ANTIMICROBIAL ACTIVITY OF *Litsea garciae* PULP AND SEED EXTRACTS

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ABSTRACT

Litsea garciae is a native plant to Borneo Island. The current study identified and compared the fatty acids composition and antimicrobial activities of the pulp and seed extracts of *L. garciae*. The total lipids of *L. garciae* pulp and seed were extracted with petroleum ether (PE) and Bligh-Dyer (BD) methods and the fatty acids were analysed using gas chromatography. The antimicrobial activities of the total lipids were determined using disk diffusion and broth microdilution assays. The predominant saturated fatty acids were palmitic acid followed by stearic acid for both PE and BD lipid pulp extracts. In contrast, the PE and BD lipid seed extracts had a high content of lauric acid followed by palmitic acid. The predominant monounsaturated fatty acid was oleic acid while polyunsaturated fatty acid was linoleic acid for all extracts. As for the antimicrobial activities, PE lipid pulp extract had higher antimicrobial activity against *S. aureus*, *P. aeruginosa* and *S. epidermidis* than other extracts in both antimicrobial assays. This study shows that the PE and BD lipid pulp and seed extracts had a similar major components of fatty acids but with different proportions. In addition, the components of fatty acids might contribute to the antibacterial activity of *L. garciae*.

Keywords: *Litsea garciae*, fatty acid, antimicrobial activity, gas chromatography.

ANTIOXIDANT AND ANTIMICROBIAL PROPERTIES OF BIOACTIVE COMPOUNDS PRODUCED UNDER SOLID-STATE FERMENTATION OF SAGO PITH WASTE BY ENDOPHYTIC FUNGI

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ABSTRACT

This research work focuses on the high production of bioactive compounds under solid-state fermentation (SSF) of sago pith waste by endophytic fungi, *Marasmius cladophyllus*, *Penicillium chermesium* and *Fusarium equiseti*. The fermentation experiments were performed for 14 days at initial moisture content of 65%, pH4.9 and temperature of 28 °C. The crude supernatant were harvested, measured for total phenolic and flavonoids contents, as well as the antioxidant and antimicrobial activities. The highest antioxidant activity of 85.96% was recorded on the crude extract of *F. equiseti*. As for *P. chermesium*, it gave the highest production of total phenolic and flavonoids contents of 1.21 mg GAE/g and 1.29 mg QE/g, respectively. The gas chromatography–mass spectrometry (GC-MS) analysis further characterized the main bioactive compounds produced as D-arabinitol, n-hexadecanoic and 2, 5 – furandione, 3-metyl-. This concludes that sago pith waste is a potential substrate to produce bioactive compounds by fungal endophytes under SSF.

Keywords: Solid state fermentation, fungal endophyte, sago pith waste, phenolic, antioxidant.

CONSUMER PREFERENCES ON HERBS AND SPICES IN SARAWAK, MALAYSIA

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ABSTRACT

The herb industry has the potential to become one of the most important contributors to Sarawak's economic growth, due to the rise in its consumption. However, the industry is still small due to a lack of initiatives in Sarawak dedicated to its development. Thus, this study is conducted to determine the preferences and demand of herbs and spices among Sarawak communities. A total of 95 respondents from 12 divisions have participated in this study. Respondents were assessed from the aspects of demography, finished herbal product preference, and factors that influence their usage of herbal products. Descriptive analysis from SPSS revealed that 75.8% of respondents preferred fresh herbs over dry and liquid extracts. From the analysis of the 26 herbs and spices listed, ginger (92.6%), calamansi (83.2%), and leaf celery (80%) were the top three preferred fresh herbs and spices in Sarawak. Meanwhile in terms of packaging type, 44.2% of respondents preferred herbs that were packed in transparent plastics bags than containers and paper bags. Findings from this study is beneficial to herbal farmers and entrepreneurs to strategize their herbal businesses in accordance with the consumers' demands and preferences. This study provides an insight on the market demand of fresh herbs and spices among Sarawak communities.

Keywords: herbs and spices, Sarawak, consumer preferences, fresh herbs, herbal demand

INDUSTRIAL, BIOLOGICAL AND PHARMACOLOGICAL USES OF *SHOREA MACROPHYLLA* L.

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ABSTRACT

Trees of *Shorea macrophylla* L. (*Engkabang jantung*) are one of the most valuable commodities in South East Asia, due to their good quality of Meranti timbers and illipe nuts that generate oil. They also produced important green industrial chemicals such as varnishes, insecticides to name a few and of medicinal values. Several related studies have proven that the wood and wood residues of *S. macrophylla* L. are suitable for the production of furniture and cattle feedstocks. At the same time, fat emulsion from the illipe nuts attracts more attention in the waxes and cosmaceutical as well as food products industries. Similarly, it has been employed as an active natural food additives in a few newly produced food products. These makes *S. macrophylla* L. an important commodity in foreign markets. In order to better unravel the potentials of this plant, further in depth studies would be required. Therefore, the purpose of this article is to review on the industrial, biological, and pharmacological applications of *S. macrophylla*.

Keyword: *Shorea macrophylla* L, illipe nuts, industrial, biological, pharmacological

FORMULATION OF ANTI ACNE SOAP AND ANTI ACNE CREAM USING FERMENTED *CURCUMA CAESIA* EXTRACT SUPERNATANT

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ABSTRACT

The global skincare industry offers a wide range of products, however, these products are possible sources of human exposure, to endocrine-disrupting chemicals. Thus, this thesis is a pioneering research on the locally grown *Curcuma caesia* that has been used as a traditional folk medicine but has not been extensively studied, by optimizing its extraction parameters, fermentation parameters and the preparation of anti-acne soap and anti-acne cream from its fermented extract. The Plackett Burman experimental design was employed in searching for significant media components that influence DPPH scavenging activity amongst the 11 chosen variables and they were optimized using FCCCD by Design Expert software version 6.0.8. Yeast extract, peptone and sucrose were found to be the critical factors influencing DPPH scavenging activity. Optimum DPPH scavenging activity with these factors was deduced using FCCCD. The highest DPPH scavenging activity of 84.25 % was obtained when concentration of yeast extract, peptone and sucrose was at 7, 8 and 10 (g/L), respectively with *C. caesia* concentration of 2 % (v/v) and *L. plantarum* concentration of 2 % (v/v). The supernatant of the optimized media was used to measure the 5-lipoxygenase (5-LOX) inhibition activity as an indicator of anti-inflammatory activity present in the supernatant and the mean activity recorded was 76.84%. Thirty respondents with acne vulgaris were selected to test the efficacy and safety of the anti-acne facial soap and cream formulated from the fermented *C. caesia* supernatant. A split face trial was carried out daily for seven days period. Significant lesion improvements and reduced numbers of acne lesions were observed on the treated side of the face. No erythema, burning, stinging, scaling, drying or edema of the skin or exacerbation of the pre-existing acne were recorded. A student's paired t-test was carried out to test the reliability of the results and the obtained p value of less than 0.05 indicates that the result is significant and that it can be replicated in a larger population.

Keywords: *C. caesia*, fermentation, Plackett Burman, anti acne soap, anti acne cream, *L. plantarum*

ASSESSMENT OF THE ANTIBACTERIAL AND ANTIBIOFILM ACTIVITY OF *UNCARIA TOMENTOSA* EXTRACTS AGAINST ORAL BACTERIA

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ABSTRACT

Uncaria tomentosa has been widely used for thousands of years in folk medicine to treat several health conditions. Various pharmacological studies conducted in vitro and in vivo indicated that this plant possessed biological activities including antioxidant, anti-diabetic, antimicrobial, and anti-inflammatory, among others. Although the antibacterial activity of *Uncaria tomentosa* has already been reported, very few studies have been done on bacteria of clinical relevance in dentistry. Furthermore, there is no study on the effect of *Uncaria tomentosa* extracts and their constituents on inhibiting oral biofilm formation. Therefore this study aimed to evaluate in vitro the antibacterial activity and antibiofilm effects of the extracts of *Uncaria tomentosa* against selected oral bacteria. The plant was extracted using solvents with varying polarities (hexane, dichloromethane, and 80 percent ethanolic). The oral bacteria tested in this study were *Streptococcus salivarius*, *Streptococcus mitis*, *Streptococcus uberis*, *Streptococcus mutans*, and *Streptococcus anginosus*. The antibacterial activities were assessed by agar-well diffusion and the resazurin microtiter assay (minimum inhibitory concentration, MIC) methods. The antibiofilm activity was investigated using a crystal violet assay. Among all extracts tested, both DCM stems and leaves extracts were active against all the tested oral bacteria and have the highest inhibitory effects against *Streptococcus mutans* with a MIC value of 234.4 µg/mL. In comparison to normal biofilm growth, the extracts reduced biofilm formation by at least 50%. The inhibition of bacterial growth and the reduction of biofilm formation of oral bacteria using *U. tomentosa* extracts shows potential in developing new antimicrobial agents to prevent and control oral diseases.

Keywords: antibacterial, antibiofilm, oral bacteria, *Uncaria*, *Uncaria tomentosa*

PRODUCTION AND EXTRACTION OF PHENOLIC COMPOUNDS FROM FERMENTED RAW SAGO STARCH BY SELECTED FUNGAL ENDOPHYTES

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ABSTRACT

Raw sago starch is one of the staple foods in the state of Sarawak. Derived from the bark of *Metroxylon sagu*, this starch has yet to be investigated of its phytochemical ability. Polyphenol content and antioxidant activity in different fermentation techniques using raw sago starch as substrate with selected endophytes, *Aspergillus niger*, *Penicillium* spp. and *Fusarium equiseti* were observed higher in solid state fermentation than in submerged culture. This study also investigated phenolic production by manipulating the fungal consortia and incubation period as well as the solvent used. It was found out that the dual culture of *Aspergillus niger* and *Penicillium* spp. showed high total phenolic content of 174.95 mg GAE/10g DW and better antioxidant activity in different concentrations of 2.0 – 0.03125 mg/mL ranging from 90.21-76.17% under solid state fermentation while mono culture of *Aspergillus niger* has better phenolic content of 20.37 mg GAE/10g DW and antioxidant capacity (DPPH radical scavenging activity and reducing power) with a range value of 90.72-14.15% and 0.281±0.046, respectively under submerged fermentation. Therefore, it is found that the best conditions for maximum phenolic content and antioxidant is the methanol extract of fermented raw sago starch inoculated with dual cultures *Aspergillus niger* and *Penicillium* spp for a period of 13 days under solid state fermentation.

Keywords: Fermentation, raw sago starch, endophytes, antioxidant

DEVELOPMENT OF INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETRY (ICP-MS) METHOD FOR DETERMINATION OF TRACE METALS IN BLACK PEPPER BERRIES

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ABSTRACT

An efficient method was developed and validated for the analysis of trace metals in black pepper berries using inductively coupled plasma mass spectrometry (ICP- MS/MS). Pepper berries were digested through microwave-assisted digestion and analysed using an ICP-MS. Pepper berries were well digested using 3 mL of nitric acid with temperature and energy used were set at 220 °C and 1000 W, respectively. ICP- MS/MS operated with helium flow rate of 5 mL/min gives the best detection capacity. This study covered 5 heavy metals (As, Cd, Hg, Pb, and Sb) with recoveries of all metals recorded in the range of 98.14-114.83% with relative standard deviation of less than 0.044%. The response showed a good linearity with correlation coefficient (R²) values above 0.999. Good selectivity and sensitivity were obtained with method limit of quantification < 0.096 mg/kg. The matrix effect (< 20%) was considered negligible. The expanded uncertainties measurements were in the range of 7.21 - 18.29%. The proposed method was applied for monitoring of trace metals in pepper berries. A total of 53.91% of samples analysed via a monitoring study, where 53.91% of the samples detected was found positive for As, Pb, and Cd. This finding indicated that the method developed is efficient in detecting targeted heavy metals in pepper samples.

Keywords: Method validation; maximum limits; Arsenic; Cadmium; Mercury; Lead; Antimony

UNLOCKING UNTAPPED RESOURCES FROM *ELAEIS GUINEENSIS* LEAF AS THERAPEUTIC AGENTS IN REGENERATIVE MEDICINE

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ABSTRACT

Ethnopharmacologically, tribes live in African continent particularly in Ghana have been using oil palm (*Elaeis guineensis* Jacq.) leaves (OPL) as medicinal plant in treating chronic wounds either in the form of squeezed juice or in powdered form. Contrary in Malaysia, OPLs are regarded as undervalued by-product generated by massive oil palm cultivation. As phytochemist, we have highlighted the presence of flavonoids particularly apigenin and luteolin derivatives in OPLs and excitingly these compounds are reported to exhibit some biological properties such as antioxidant, anti-inflammatory and wound healing properties. At present, there is no method of efficiently harnessing OPLs for production of useful fine chemicals for health and other applications. Henceforth, in view of OPLs as source of bioactive compounds, effective extraction and enrichment protocols to produce standardized flavonoid enriched extract from OPLs are needed in order to turn this by-product into a useful resource. With this goal in mind, we are passionate to develop a more sustainable processing method in tapping these bioactive compounds from OPLs which in line with our aspiration towards making a more sustainable Malaysian oil palm industry. After years devoting in this research, here we proudly showcase our product, FlavoRich, a standardized flavonoid enriched extract produced from our in-house phytoneering technology where we integrated three key elements comprising ultrasonic-assisted green solvent extraction for high efficiency in flavonoid liberation, chemical pretreatment for target specificity, and macroporous adsorption resin for selective entrapment. FlavoRich was further nanoencapsulated into hydrogel system as a strategic botanical drug delivery approach for topical wound healing application. FlavoRich was standardized to its four isomeric chemical markers i.e orientin, isoorientin, vitexin and isovitexin using state of the art UHPLC and LCMS/MS techniques. With 3.5-fold total flavonoid enrichment, FlavoRich and its nanogel have shown enhanced antioxidant, anti-inflammatory and wound healing activities at safe doses using both *in vitro* and *in vivo* models.

ENTOMOPATHOGENIC FUNGI AS POTENTIAL SOURCE FOR LACCASE ENZYME

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ABSTRACT

Entomopathogenic fungi (EPF) are also known as natural enemies of insects and can be found in dying insects and at soil. Apart from that, due to the pathogenicity of EPF, the worldwide studies have found the use of this fungi as potential insect pests control agents. Many fungi have been found capable of producing laccase enzyme however, there are little evidence that shows the ability of EPF to produce laccase enzyme. Hence, the objectives of this research project were to isolate and identify entomopathogenic fungi as well as to evaluate their potential in producing laccase. The EPF were isolated from both the soil samples and dead insect cadavers collected within Saratok area. They were isolated by planting the samples onto selective agar medium before culturing the fungi onto malt extract agar (MEA) to obtain pure cultures. All isolated fungi were then screened for laccase production on agar plate via oxidation of guaiacol. Out of then fungi isolated and screened qualitatively, three were found to produced laccase. Further molecular identification was conducted on these 3 isolates revealed their identities to be *Lecanicillium araneicola* UMAS S19, *Pochonia chlamydosporia* UMAS I27 and *Beauveria bassiana* UMAS I28. EPF therefore can be a potential source for laccase enzyme.

Keywords: Entomopathogenic fungi, insect cadaver, soil sample, laccase enzyme.

BIOACTIVITIES, PHENOLIC AND CAROTENE OF *AURANTIOCHYTRIUM* SW1 SP. HARVESTED WITH DIFFERENT FLOCCULANT

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ABSTRACT

Microalgae is being considered as a potential substitute of polyunsaturated (PUFA) oils supply, particularly docosahexaenoic acid (DHA), to fish oil, the most common source of DHA and eicosapentaenoic acid (EPA). Extraction of microalgal oil with high bioactivities due to the co-extracted bioactive compounds will undoubtedly increase its potency and marketability. *Aurantiochytrium* SW1 was previously successfully isolated from Malaysian coastal waters. This study was conducted to determine the bioactivities, phenolic and carotene content of *Aurantiochytrium* SW1 sp. microalgae harvested using different flocculant - gum arabic (FA), cationic guar gum (FG) and okra gum (FO). Significantly highest ($p \leq 0.05$) DPPH radical scavenging activity and FRAP were observed in oil extracted from FG flocculation. It was found that the flocculant material greatly influenced the total phenolic content (TPC). FO flocculation was found to greatly influenced the carotene content of the microalgal oil. The findings from this work provides a better understanding on the potential health benefits of microalgal oil from locally isolated *Aurantiochytrium* SW1.

Keywords: β -carotene content, antioxidants activity, flocculant, phenolic content,

POTENTIAL THERAPEUTIC APPLICATION OF PHYTOMEDICINES FOR SARS-COV-2 INFECTION: CASE REPORT AND REVIEW

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ABSTRACT

The spread of a novel coronavirus has led to a global pandemic. COVID-19 is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) which is a highly transmissible coronavirus. This case study documents clinical improvement of a patient with SARS-COV-2 infection. The SARS-CoV-2 RT-qPCR assay on a nasopharyngeal swab was positive (CT value of 19.3). The patient presented with symptoms, namely fever and cough and consumed a combination of phytomedicine. The patients experienced a reduction in clinical symptoms and a subsequent PCR test revealed a reduction in viral load (CT value of 35.43). A review of pharmacological activities of the components of the phytomedicines suggests a wide range application for prophylaxis or therapeutic interventions against COVID-19. Therein lies a potential for drug discovery and development.

Keywords: Phytomedicine, Herbal, COVID-19, SARS-Cov-2

PHYTOTHERAPEUTIC APPROACHES FOR MANAGEMENT OF HYPERURICEMIA IN GOUT

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ABSTRACT

Gout is a disease characterized by hyperuricemia. It is one of the most common type of arthritis especially in men over the age of 40 years. Despite its clinical prevalence and relatively well-understood pathogenesis and risk factors, gout remains suboptimally managed. In this study, we examined whether Western phytotherapeutics offer any benefits in the effort to manage hyperuricemia in gout. Though there are promising extracts from plants such as *Apium graveolens*, *Urtica urens* and *Taraxacum officinale*, these studies are largely based in hyperuricemic mouse models. Reversals of elevated serum uric acid levels can be noted in these studies and additional benefits may be conferred including renal protective effects. Nevertheless, there is a paucity of clinical trials. Well-designed randomized clinical trials are required to assess the effectiveness of phytotherapeutics for gout.

Keywords: Gout, Hyperuricemia, phytotherapeutics, Phytotherapy

Traditional Knowledge Documentation and Useful Plants: Case Studies in Sarawak

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ABSTRACT

Traditional Knowledge Documentation encompasses interactions between people and plants, ethnofloristic richness, the relative importance of useful species richness in relation to general species richness, and plant management in the Sarawak. SBC through Traditional Knowledge Documentation Project has recorded a total of 1,792 useful vascular plant in Sarawak. The null hypothesis that plant families with a higher number of useful species would be those having a higher general species richness was analyzed through the residuals method. The plant families richest in useful species were Annonaceae, Acanthaceae, Araceae, Arecaceae, Fabaceae and Zingiberaceae, most of which also have the highest general floristic richness. A total of 1,335 species has been identified, more than 500 species are submitted to some type of management (34 protected and 158 cultivated), but only a few have been studied to document their process of domestication. Based on the survey, 146 plant species had been studied and developed into products that can be marketable. A total of 556 species had been recorded potentially for pharmaceutical products. This information can be used for developing regional strategies for the sustainable management of plant resources in Sarawak.

**SUSTAINABLE MANAGEMENT OF ESSENTIAL OIL PLANT,
ADENOSMA NELSONIOIDES: A CASE STUDY WITH BIDAYUH OF
KPG SEMADANG AND IBAN OF RH SIMON UNDER ADENOSARA®
PROJECT**

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ABSTRACT

Bunga Ta'ang, known scientifically as *Adenosma nelsonioides*, is an aromatic herb that means *hardy flower* by the Bidayuh community. Traditional uses of Bunga Ta'ang were first recorded by Sarawak Biodiversity Centre (SBC) in 2007 for the treatment of skin ailments such as rashes and itching as well as to prevent fleas and ticks on domestic animals by the Bidayuh of Kampung Semadang, Penrissen, Kuching. In 2015, the second discovery of the plant were used by the Ibans of Rumah Simon, Lubok Antu during one of the follow up trip by SBC to the village, which known as Bangkit Engkerawan. *Adenosma nelsonioides* grows primarily on paddy fields following the rice harvest and some would even consider it as a weed. The laboratory analyses unveiled the main active compound to be carvacrol, a well-known natural compound with antimicrobial, antioxidant, and anticancer properties in which it has been commercialized under the trademark of AdenoSara®. Hence, the communities of Kampung Semadang and Rumah Simon especially the women which have been empowered by taking on a leading role in cultivating *A. nelsonioides* with good agricultural practices and able to produce high quality of AdenoSara® oil. Sustainable management of *Adenosma nelsonioides* is one of the best ways of ensuring the availability of these invaluable resources for continuous production and future generations. With local communities effort in establishing the community farm, the raw materials are managed reliably and sustainably by having 3 cycles per year. This case study showed both communities of Kampung Semadang and Rumah Simon have transmute a weed into a potentially essential oil producing herb through sustainable community farm management.

Keywords: Traditional knowledge, sustainable management, farming, herb, weed, essential oil, indigenous, communities, Sarawak

NUTRITIONAL COMPOSITION AND HEALTH PROMOTING PROPERTIES OF PIPER NIGRUM TEA IN SARAWAK

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ABSTRACT

The present study relates to the young leaves extracts of the *Piper nigrum* (pepper) sampled from the local farm in Sarawak. Pepper tea was developed from *P. nigrum* leaves air-dried and incorporated with the fermented and unfermented process mimic to commercial tea development. In this study, pepper tea was evaluated and compared with commercialised tea for a series of bioassays such as anti-oxidant assays, anti-diabetic analysis, proximate analysis, chemical profiling using High Resolution Liquid Chromatography and elemental analysis using ICP-MS/MS. Sample was further extracted by using methanol and hexane solvents namely sequential successive maceration extraction and accelerated solvent extraction methods. As a result, pepper tea infusion can be used to replenish antioxidant requirement in body. Pepper leaves was also found to exert high inhibitory activity against α -amylase enzyme contributing to anti-diabetic properties, high protein content, promising anti-cancer activity against colorectal cancer cell lines as well as classified as Category 5 according to the Globally Harmonised System for the classification of chemicals with acute oral toxicity test. The aim of this project was to produce one prototype of pepper based health drink with health promoting benefits. The success of this project will elevate the pepper planting industry to another level.

Keywords: *Piper nigrum*, unfermented, anti-oxidant, anti-diabetic, anti-cancer.

PHOTOPROTECTIVE EFFECT OF *CITRUS LIMON* AND *CITRUS X SINENSIS* PEELS: COMPARATIVE INVESTIGATION OF THE EFFICIENCY OF FIVE EXTRACTION SOLVENTS

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ABSTRACT

Photoaging and photocarcinogenesis are primarily caused by repeated exposure to ultraviolet (UV) radiation. The use of phytochemical with an antioxidant capacity as photoprotector has increased recently. Citrus fruit's waste such as peels are considered as one of the resources of antioxidant. The aim of this study was to investigate the effect of five Soxhlet extraction solvents i.e., hexane, chloroform, acetone, ethyl acetate and ethanol on the photoprotective activity of *Citrus limon* and *Citrus x sinensis* peels. The antioxidant activity of the extract was evaluated using 2,2'-diphenyl-1-picrylhydrazyl (DPPH) assay while photoprotective properties was investigated based on sun protection factor (SPF) and UV absorption ability. The acetone extract of *C. limon* (IC₅₀:15.30±2.13mg/mL) and *C. x sinensis* (IC₅₀:26.05±5.19mg/mL) peels exhibited the highest antioxidant activity while ethanolic, ethyl acetate and chloroform extracts of *C. x sinensis* peel exhibited similar scavenging activity with IC₅₀ values ranging between 31-33mg/mL ($p>0.05$). Hexane extract of both fruit peels showed the lowest antioxidant activity (IC₅₀>50mg/mL). Interestingly, the opposite was observed in photoprotective activity for *C. limon* peel extracts with chloroform extract showed the highest photoprotective activity (SPF:9.06±1.96) followed by hexane (SPF:6.96±0.22), ethyl acetate (SPF:5.11±1.63), ethanol (SPF:4.95±2.38) and lastly acetone (SPF:1.39±0.40). Similarly, acetone extract of *C. x sinensis* peels demonstrated the least photoprotective activity (SPF:1.96±0.28) followed by ethanolic extract (SPF:2.70±0.51). Three extracts i.e., hexane (SPF:6.75±0.33), ethyl acetate (SPF:7.34±0.05) and chloroform (SPF:7.90±0.12) of *C. x sinensis* peel revealed similar potential in photoprotection. The correlation between both DPPH IC₅₀ and SPF values of *C. limon* and *C. x sinensis* peel extracts are not significant ($p>0.05$). In terms of UV absorption, all extracts of *C. limon* peel demonstrated high UV absorption at UVB region (280-320nm) except acetone extract with high UV absorption at UVA region (320-400nm). Meanwhile, all extracts of *C. x sinensis* peel showed broad absorption at UVA and UVC regions with the highest absorption detected at 310-350nm. This finding suggests that ethyl acetate extract of *C. x sinensis* could be used as a natural sunscreen in pharmaceuticals due to its valuable antioxidant and photoprotective activities.

Keywords: Antioxidant, *Citrus lemon*, *Citrus x sinensis*, photoprotective, sunscreen

BOTANICAL-BASED COSMETICS: SUBSTANTIATING TRADITIONAL KNOWLEDGE

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ABSTRACT

Adenosma nelsonioides is a shrubby weeds-like plant that appears alongside the paddy field, emitting a strong odour that attracted the communities' attention. When the dried plants are placed in the chicken coop, the community realised its repellence effect, protecting their chicken from ticks. Traditionally use, when the plants are applied to skin rashes, the itchiness fades away, which is indicative of a potential antimicrobial and antifungal effect, earning its place as one of the documented bioactive plants in the Sarawak Biodiversity Centre's Natural Product Library. The plant's essential oil was screened for antibacterial, antifungal and antioxidant activities. The oil showed potent antimicrobial activity, with inhibitory action against *K. pneumonia*, *S. aureus* and *C. albicans* comparable to the commonly used antiseptic, Triclosan (MIC = 1mg/mL). The plant's essential oil also exhibited antioxidant activity when tested through DPPH Scavenging Assay with a radical-scavenging activity of 33.8%. Its scent, analogous to oregano, comes from the complex mixture of seven identified compounds through mass spectrometry, with major components of carvacrol (>50%), γ -terpinene (>18%), o-cymene (>10%) and β -bisabolene. The indigenous nature of *A. nelsonioides* plant, therefore, provides a unique opportunity for Sarawak, to propose its own Geographical Indicator (GI) protected ingredient as the natural cosmetic active ingredients, as well as a substitute to the now FDA-banned Triclosan. Just recently, the plant's essential oil was successfully registered as a cosmetic ingredient in the globally recognised International Nomenclature of Cosmetic Ingredient (INCI)'s library.

Keywords: Antimicrobial; Antioxidant; Aromatic plant; Bioproduct; Essential oil

A REVIEW ON THE AMELIORATING EFFECTS OF *TINOSPORA* EXTRACTS ON THE FORMATION OF ADVANCED GLYCATION END-PRODUCTS (AGES) AND ASSOCIATED OXIDATIVE STRESS

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ABSTRACT

Tinospora is a plant genus widely distributed in Southeast Asia, where it is used as traditional medicine. Extracts from the stem and leaves of *T. crispa* and *T. cordifolia* are rich in phytochemicals like flavonoids, terpenoids, alkaloids etc., which are known for their hypoglycemic and/or antioxidant effects. Diabetes- induced hyperglycemia triggers an increased formation of advanced glycation endproducts (AGE) which are associated with inflammation and oxidative stress causing diabetic complications. Little is known about the effects of *T. crispa* and *T. cordifolia* on AGE formation and oxidative stress. Therefore, we reviewed the literature of the last 20 years about effects of *Tinospora* extracts on the AGEs formation. An online data base search with the keywords "*Tinospora*", "advanced glycation end products", "oxidative stress" and "diabetes" was conducted. Multiple articles with these keywords were found. Glucose lowering *Tinospora* constituents mainly belonged to the group of terpenoids e.g., borapetoside A and borapetol A while alkaloids like berberine and palmatine reduced AGE formation. Flavonoids showed to be protective against AGE-associated oxidative stress. Nonetheless, more in depth studies using extracts of stem and leaves need to be carried out *in vivo* and *in vitro* to understand the protective mechanism of the extracts.

Keywords: Advanced glycation end products, diabetes, oxidative stress, *Tinospora*.

SEQUENTIAL SOLVENT EXTRACTION METHOD IN ISOLATING THE MITRAGYNINE FROM DIFFERENT GENUS OF MITRAGYNA SPECIOSA LEAVES PLANTED IN SARAWAK

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ABSTRACT

Mitragyna speciosa is ethno homeopathic plant herbs that is commonly found in the Southeast Asian region including Malaysia and have been traditionally used since the early 19th century for remedial purposes. The main compound of *M. speciosa* is an alkaloid named mitragynine (9-methoxycorynantheidine) in which the content may differ due to the proportional geographic area. The aim of this study is to applied sequential solvent extraction method to isolate the mitragynine and identified its content in three types of *M. speciosa* leaves that found in Sarawak. The study involved three types of *M. speciosa* locally known as *ketum merah*, *ketum putih* and *ketum jambu* which identified to have different leaves morphology. Series of solvents, primarily hexane (non-polar solvent), secondly chloroform (mid-polar solvent) and lastly methanol (polar solvent), were used to extract the leaves and the weights of each extracts were documented. It was found that *ketum jambu* contains more polar compounds compared to others. Gas Chromatography-Mass Spectrometer (GCMS) was used to identify mitragynine and it is found in all type of *M. speciosa* leaves that were extracted by using chloroform and methanol. Based on the measurement of the peak area in GCMS chromatograms, it shows that mitragynine is best dissolved in polar solvent.

ANTIBIOTICS SUSCEPTIBILITY TESTING AGAINST *LEPTOSPIRA* SPP. ISOLATED FROM ENVIRONMENT SOURCES IN SARAWAK

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ABSTRACT

Leptospirosis is a zoonosis disease with various signs ranging from asymptomatic, mild to severe and even death which is caused by pathogenic *Leptospira*. Significant increased reported cases over the last decade of leptospirosis in Malaysia showed that it is critical to assess how effective conventional antibiotics are at monitoring this species. Besides, the antibiotic susceptibilities of *Leptospira* from are limited in Malaysia. Hence, the objective of this study was to determine the susceptibilities of *Leptospira* isolates obtained from the environmental sources at different locations by using broth microdilution method. Twelve *Leptospira* isolates from environment were tested against seven antibiotics (penicillin G, doxycycline, ampicillin, amoxicillin, cefotaxime, chloramphenicol, and erythromycin). They were commonly used in previous studies on antibiotic susceptibility of *Leptospira*. Overall, all 12 tested isolates *Leptospira* spp. were more susceptible toward cefotaxime and erythromycin with MIC₉₀ 0.2 µg/mL, as compared to amoxicillin and ampicillin with MIC₉₀ 0.39 µg/mL. Meanwhile, doxycycline exhibited the highest MIC₉₀ value of 5.938 µg/mL. Overall, all tested antibiotics employed in this study showing their effectiveness against isolated *Leptospira* spp isolated from environmental sources in Sarawak.

Keywords: *Leptospira*, broth microdilution, environment sources, antibiotics

HPLC QUANTIFICATION OF 6-GINGEROL AND 6-SHOGAOL IN SOIL-BASED AND SOILLESS GINGER

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ABSTRACT

Ginger is a well-known herbal medicine. Its major bioactive compounds, 6-gingerol and its dehydrated form, 6-shogaol, are reported to have potential medicinal properties. However, pre-existing studies on the compounds are limited to conventionally grown or soil-based ginger. Soilless ginger cultivation technique has been widely adapted as an alternative to avoid soil related complications, yet its biochemical constituents has not been reported in literature. Therefore, this study aims to compare the marker compounds, 6-gingerol and 6-shogaol using high performance liquid chromatography (HPLC) in soilless and soil-based ginger extracted at different ethanol concentrations. Dried young gingers were extracted using the reflux method with 95% and 100% ethanol at 60°C. An isocratic HPLC method was carried out following the Malaysian Herbal Monograph guidelines using C18 column (250 mm x 4.6mm, 5µm particle size) with a flow rate of 1.0 mL/min and absorbance of 225nm. The mobile phase consisted of 55 volume of acetonitrile, 44 volume of 0.1% phosphoric acid and 1 volume of methanol. The linearity ranges of 6-gingerol and 6-shogaol were obtained over 25-125 µg/ml with a R² value of 0.998. The mean recovery (%) for 6-gingerol and 6-shogaol is 94.44% and 99.29% respectively. The limit of detection (LOD) and limit of quantification (LOQ) for 6-gingerol were 10.50 and 31.80 µg/ml and for 6-shogaol were 5.54 and 16.78 µg/ml respectively. The RSD values from repeated extractions for 6-gingerol and 6-shogaol were 0.08 and 0.34 respectively. All parameters for the system suitability test meet the acceptance criteria. The percentage concentration of 6-gingerol in both 95% and 100% ethanolic soil-based ginger extract (0.17% and 0.02% respectively) is higher than in soilless extract (0.05% and 0.004% respectively). On the other hand, the percentage concentration of 6-shogaol in 95% ethanolic soilless ginger extract (0.01%) is higher than in soil-based extract (0.001%), while for extracts using 100% ethanol, soil-based extract (0.001%) has higher shogaol content than soilless extract (0.0005%). Overall, the total biomarker compound in soil-based ginger extracted in both 95% and absolute ethanol is higher compared to soilless ginger.

Keywords: 6-gingerol; 6-shogaol, High performance liquid chromatography, Soilless plantation, *Zingiber officinale*

SCREENING OF ANTIBACTERIAL ACTIVITY OF *NEOLAMARCKIA MACROPHYLLA* LEAF CRUDE EXTRACT

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ABSTRACT

Neolamarckia macrophylla (Roxb.) Bosser belongs to genus *Neolamarckia* of the family Rubiaceae which commonly known as the red kelampayan by the locals. It is an important timber tree that is used for reforestation, the woods used as raw materials of paper and plywood, while its bark used to relive fever in traditional medicine (Shi *et al.* 2020; Qalbi *et al.*, 2019). The aim of this study was to determine the antimicrobial potential of *N. macrophylla* leaf crude extract. The crude extract was obtained using maceration technique using ethanol and distilled water as solvent for the extraction process. The antibacterial activities were screened against *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*, *Listeria monocytogenes*, *Staphylococcus aureus* and *Bacillus cereus* with different concentration of the crude extract (12.5 mg/mL, 25 mg/mL, 50 mg/mL and 100 mg/mL) by using disc diffusion method. The test bacteria demonstrated inhibition zone between 7 to 10 mm with the linear increase of inhibition zone with concentration of extract. This findings provide preliminary results on the antibacterial potential of *N. Macrophylla* to be used in various application. Further purification of compounds might be necessary to explore more on its optimum potential.

Keywords: antibacterial activity, leaf extracts, *Neolamarckia macrophylla*.

PRELIMINARY STUDY ON ANTIFUNGAL ACTIVITY OF *NEOLAMARCKIA MACROPHYLLA* LEAVES EXTRACT

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ABSTRACT

The genus *Neolamarckia* includes two species which are *N. macrophylla* and *N. cadamba*. Many research have been done on various aspect of *N. cadamba* including the antimicrobial and the phytochemical compounds in the extract of different part of the tree (Qureshi *et al.*, 2021; Islam *et al.*, 2015). In contrary with *N. cadamba*, there are very limited research study on *N. macrophylla*. The aims of this research were to extract the antifungal properties of *N. macrophylla* leaf using aqueous and methanol extraction followed by the evaluation of antifungal activity of the leaf extracts against *Aspergillus flavus*, *Aspergillus niger* and *Fusarium solani*. Extracts of different concentration (12.5 mg/mL, 25 mg/mL, 50 mg/mL and 100 mg/mL) were spread on the potato dextrose agar to evaluate the fungi growth using the poisoned food technique. The results were compared with the normal growth of the fungi in potato dextrose agar. The results on fungi growth showed inconsistency of inhibitory effect on the test fungi exhibiting inhibition percentage within the range of 4-80%. Further improvement on the evaluation of antifungal activity needed in future research to obtained consistent results as to ensure validity of the data.

Keywords: antifungal activity, leaf extracts, *Neolamarckia macrophylla*.

PICKERING EMULSIFIER FROM PEPPER (*Piper nigrum* L.) AGRO-INDUSTRIAL WASTE

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ABSTRACT

The growing demand for white pepper has led to vast amount of agro-industrial waste. White pepper is obtained through water retting process whereby its outer pericarp will be removed, and the waste is directly discarded into the rivers. These agro-industrial wastes contain hemicellulose, cellulose, pectin and other organic compound which could be utilized as valuable source for various application. The solid cellulosic particles have been demonstrated to be able to stabilized the oil-water interface, hence act as a Pickering emulsifier. Therefore, it is interesting to investigate the potential extraction of cellulosic particles from the pepper pericarp. Proximate analysis of pepper pericarp showed that it contained 73.74% carbohydrate, 10.40% moisture, 10.25% protein, 2.90% fat and 2.70% ash. Alkali treatment followed by bleaching process was used to extract the cellulose fibers. The different condition in bleaching treatment affects the structure of cellulose fibers. The creaming index of emulsion sample with 1% of cellulose showed a significant difference ($p < 0.05$) on the fifth, seventh, tenth, and fourteenth days of storage. The emulsion stabilizing capability demonstrated by the pepper pericarp waste cellulose demonstrated a potential application that can support towards a zero waste agro-industry.

Keywords: water retting, cellulosic particles, emulsifier, creaming index, sustainability

Extraction of Residual Oil from Palm Oil Mill Effluent (POME)

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ABSTRACT

Palm oil mill effluent (POME) is oily wastewater produced during palm oil processing process. When organic compounds, such as residual oil in POME, are released into the environment, they deplete oxygen, causing harm to aquatic ecosystems. As a result, effective treatment methods for POME should be done before it is discharged into streams. In this study, residual oil is extracted before it can be safely released as effluent. POME residual oil was extracted using soxhlet extraction technique using two different solvents; methanol and *n*-hexane. For qualitative analysis of the extracted oil, Fourier Transform infrared (FT-IR) spectroscopy was used, and brine shrimp toxicity was tested on the POME to determine whether the POME has toxic effect on the organisms. The results show that 0.05g and 0.07g of oil were extracted from 500 mL of POME using the soxhlet method with methanol and *n*-hexane, respectively. Peaks at 3405 cm⁻¹ indicate carboxylic acid O-H stretch, while peaks at 2923 cm⁻¹ and 2852 cm⁻¹ indicate C-H stretch. Other peaks at 1745 cm⁻¹ and 1103 cm⁻¹ correspond to C=O stretch and C-O stretch, respectively. The functional groups found are similar to those found in unsaturated fatty acids like linoleic acid in palm oil. Brine shrimp mortality test results show a 100% mortality rate when the shrimps were exposed to POME, indicating that POME alone is toxic to aquatic organisms.

Keywords: Palm oil mill effluent (POME), residual oil, soxhlet extraction, brine shrimp mortality

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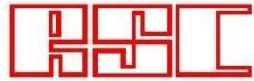
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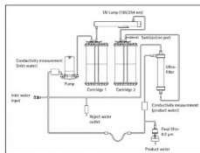
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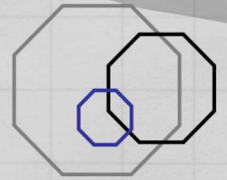
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