Persatuan Penyelidik dan Pengusaha Cendawan Malaysia (PPPCM)

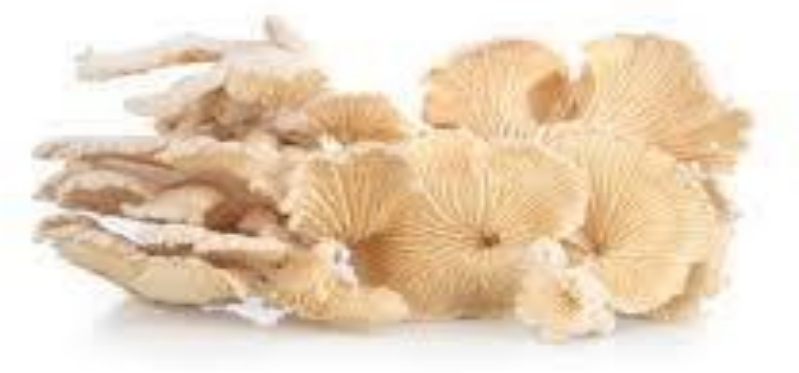
(Previously known as Malaysian Mushroom Research Association)

International Mushroom Webinar 2021

20 December 2021

Themes

- Mushroom Cultivation
- Postharvest Techniques
- Mushroom Costing
- Downstream Products
- Mushroom Foresight
- Waste Management
- Functional Properties
- Disease Control
- Mutation Induction



Persatuan Penyelidik dan Pengusaha Cendawan Malaysia (PPPCM) International Mushroom Webinar 2021

Persatuan Penyelidik dan Pengusaha Cendawan Malaysia (PPPCM) in Brief

Persatuan Penyelidik dan Pengusaha Cendawan Malaysia (PPPCM) or previously known as MMRA provide mushroom growers with information relating to improvement of mushroom culture techniques and other problems associated with mushroom industry. PPPCM also promote mushroom as a health food to the general public and thereby encouraging competitive growth of mushroom industry. Other than that, PPPCM strive to search for new varieties preferably local varieties of mushroom for cultivation and promote mushroom biology (among academic and graduate students) research which are industry driven.

International Mushroom Webinar 2021

List of Oral/Poster Presenter

No	Name	Title	Oral/Poster
1	Dr Jaya Seelan Sathiya Seelan	Phylogenetic relationships of *Lentinus* sensu stricto (Polyporaceae, Basidiomycota) with emphasis on section Rigidi and Dicholamellatae from Southeast Asia	Oral
2	Assoc. Prof. Dr Tan Yee Shin	Assessment of Inter-Simple Sequence Repeat marker (ISSR) to reveal genetic diversity among *Trichoderma* isolates in Grey Oyster Mushroom Farm	Oral
3	Mohd Irwani Hafiz Bin Sahid	The value added 'keropok lekor' with mushrooms	Oral
4	Raziatull Syahella Binti Razali	An Analysis on Nutritional Values and Consumers'acceptance Of *Pleurotus Sajor-Caju* and *Schizophyllum Commune* Mushrooms	Oral
5	Noor Azrimi Umor	Potential of mushroom spent Oil Palm Empty Fruit Bunch (OPEFB) substrate from *Volvariella volvacea* cultivation for renewable energy	Oral
6	Muhamad Fakhrul Radzi Bin Muhamad Pikri	Preliminary Study of Alkaline Materials Treatment on Grey Oyster Mushroom (*Pleurotus pulmonarius*) in spawning and mushroom production	Oral
7	Ain Syazween	Crucial steps in preparing substrate seedlings for paddy straw mushroom (*Volvariella volvacea*) cultivation	Oral
8	Sugenendran Supramani	Landless Mushroom Cultivation via Fabricated-Bioreactor Systems for efficient Biomass and Beta-glucan Production	Oral
9	Ana Doroški	Oyster mushroom (*Pleurotus ostreatus*) cultivation on different food waste originated substrates	Oral
10	Ts Chm Dr Khalisanni Khalid	Oyster Mushroom Nutrition Facts and Health Benefits	e-poster
11	Nurul Izzati Binti Wajir	Utilization of spent mushroom substrates.	e-poster
12	Ainin Soffiya Binti Muhammad Sabri	Foresight for in-vitro propagation in edible mushroom	e-poster
13	Nurfarah Aisyah Binti Mohd Hanip	Local edible mushroom disease from nature	e-poster
14	Mohd Salleh Bin Sidek	Bongkah penanaman cendawan komersial bagi kemantapan pertumbuhan miselium	e-poster
15	Nur-Hidayah Azman	Review On Nutritional Composition, Medicinal Properties of Edible Mushrooms And Potential Valorisation Of Mushroom Waste Product As Functional Food Product Development	e-poster

FOREWORD
BY THE PRESIDENT

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

Welcome to the International Mushroom Webinar 2021. The seminar is organised by Malaysian Mushroom Research and Growers Association (Persatuan Penyelidikan dan Pengusaha Cendawan Malaysia: PPPCM). PPCM was formed in 1999 with No. Registration: PPM-020-14-27041999 and rebranded as PPPCM to facilitate and serve mushroom industries in 2021. The determination of its establishment is to assist mushroom growers in increasing crop yields, obtain technical information, sales network and raw resources, encourage mushrooms as a food sources, promote mushroom as hobbies, solving problems in mushroom industries and introduce new varieties to mushroom growers. Congratulations to PPPCM who have achieved and managed to organise the mushroom talk in the webinar platform. The Mushroom Webinar 2021 is intended as a venue for presentation and discussion of research from both academia and mushroom industry players, on a range of exciting and timely topics in mushroom industries, its technology, farm management, experiences, knowledge sharing and related fields. It is believed that, the Mushroom Webinar 2021 will fulfil the needs of growers, researchers, students and even people who are interested in mushroom industries. Our hope, PPPCM as a reality platform to provide the needs and desires of mushroom growers and entrepreneurs in Malaysia. To all participants, wishing you a successful seminar and have a pleasant sharing and new networking areas.

Ts. Dr. Azhar Mohamad
President
Persatuan Penyelidik dan Pengusaha Cendawan Malaysia

FOREWORD
BY THE CHAIRMAN

It is with great pleasure I would like to welcome all of the speakers and delegates to International Mushroom Webinar 2021. Although due to current pandemic situation, conferences and seminars has moved to be on an online platform, that would not halt the process of knowledge sharing. This Mushroom Webinar brings together six renown invited speakers from different countries whom will be sharing various topics relevant to mushroom industry from cultivation, processes involved, technologies that could be applied, bio fortification and alternative substrates for growing various types of mushroom. Additionally, common mistakes and practises used for calculating mushroom yield and costing issues will be covered. Apart from the invited speakers, we also have oral and poster presenters to tackle and bring close to current research being carried out in this field. Hence, I hope that participants would have a fruitful discussion among each other to subsequently lead the mushroom farming and research to meet the consumer demand in Malaysia.

Ts. ChM. Dr. Raseetha Vani Siva Manikam
Chairman International Mushroom Webinar 2021
Senior Lecturer, Faculty of Applied Sciences,
Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia.

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International Mushroom Webinar 2021

Program Tentative

20 December 2021	
0845-0900	Registration of Participant (Join webinar in google meet)
0900-0910	Welcoming Remarks – Chairman **Ts. ChM. Dr. Raseetha Vani Siva Manikam**
0910-0930	Opening Address - President PPPCM **Ts. Dr. Azhar Mohamad** **MONTAGE DISPLAY**
0930-1000	**Invited Speaker 1** -Ts. Dr Azhar Mohamad, Malaysian Nuclear Agency, Malaysia **An acute gamma radiation technique in getting new potential high-quality strains of edible mushrooms for commercialization**
1000-1030	**Invited Speaker 2** - Mr Nabil Sanusi Nas Agro Farm Sdn Bhd, Malaysia **Costing For Mushroom Bags and Fresh Mushrooms**
1030-1100	Invited Speaker 3 - Dr Ganisan Krishnen Malaysian Agricultural Research and Development Institute (MARDI), Malaysia **Research, development and commercialization of mushroom technologies generated by MARDI**
1100-1130	**Invited Speaker 4** - Dr Iwan Saskiawan, Research Center for Biology, National Research and Innovation Agency of Indonesia (BRIN), Indonesia **Title: Biofortification of selenium on *Pleurotus ostreatus***
1130 –1200	**Invited Speaker 5** - Dr Hamid Yusoff Universiti Teknologi MARA (UiTM) , Malaysia **IOT-based monitoring system for oyster mushroom under control environment**

1200-1220	**Oral 1** - Dr Jaya Seelan Sathiya Seelan, University Malaysia Sabah (UMS), Malaysia **Phylogenetic relationships of *Lentinus* sensu stricto (Polyporaceae, Basidiomycota) with emphasis on section Rigidi and Dicholamellatae from Southeast Asia**
1220-1240	**Oral 2** - Assoc. Prof. Dr Tan Yee Shin University of Malaya, Malaysia **Assessment of Inter-Simple Sequence Repeat marker (ISSR) to reveal genetic diversity among *Trichoderma* isolates in Grey Oyster Mushroom Farm**
1240-1300	**Oral 3** - Mohd Irwani Hafiz Sahid University of Malaya/ Malaysian Agricultural Research and Development Institute (MARDI), Malaysia **The value added 'keropok lekor' with mushrooms**
1300-1400	**e-Poster and Break Session**
1400-1420	**Oral 4** - Raziatull Syahella Binti Razal**i** Nilai Polytechnic, Malaysia **An Analysis On Nutritional Values and Consumers'acceptance Of *Pleurotus sajor-caju* and *Schizophyllum commune* Mushrooms**
1420-1440	**Oral 5** - Noor Azrimi Bin Umor Universiti Putra Malaysia (UPM), Malaysia **Potential of mushroom spent Oil Palm Empty Fruit Bunch (OPEFB) substrate from *Volvariella volvacea* cultivation for renewable energy**
1440-1500	**Oral 6** - Muhamad Fakhrul Radzi Bin Muhamad Pikri Universiti Putra Malaysia (UPM), Malaysia **Preliminary Study of Alkaline Materials Treatment on Grey Oyster Mushroom (*Pleurotus pulmonarius*) in spawning and mushroom production**
1500-1520	**Oral 7** - Ain Syazween Universiti Teknologi MARA (UiTM), Malaysia

	Crucial steps in preparing substrate seedlings for paddy straw mushroom (*Volvariella volvacea*) Cultivation
1520-1540	**Oral 8** - Sugenendran Supramani University of Malaya, Malaysia **Landless Mushroom Cultivation via Fabricated-Bioreactor Systems for efficient Biomass and Beta-glucan Production**
1540-1600	**Oral 9** - Ana Doroški University of Belgrade, Serbia **Oyster mushroom (*Pleurotus ostreatus*) cultivation on different food waste originated substrates**
1600-1630	**Invited Speaker 6** – Dr Jovana, University of Belgrade, Serbia **Title: Alternative substrates for commercial mushroom cultivation**
1630-1645	**Closing remarks** Prof. Dr. Vikineswary Sabaratnam Mushroom Research Centre, Institute of Biological Sciences, Faculty of Science University of Malaya

Abstracts for Invited Speakers

An acute gamma radiation technique in getting new potential high-quality strains of edible mushrooms for commercialization

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Abstract

Pleuorotus sp., *Volvariella* sp., *Schizopylum* sp. and *Auricularia* sp. are prevalent cultivation strains in Malaysia for commercialization. These mushrooms are easy to handle in our climate as it requires optimal condition to grow, highly demand and easy in penetrating market demands. Further, these mushrooms are suitable to grow at temperature between 25-30 ℃ with ambient humidity between 80- 95% under good ventilation. Variability in mushroom species is important for growers to use as seedling resources for mushroom cultivation. High quality mushroom strains can be derived from the mushroom variability and are significant in reducing loses during harvesting. These mushroom strains produce high yielding fruiting body under limited space area, fast growing and tolerant to global warming condition. In creating variability at genetic background of the species, mutation induction via acute gamma radiation found to be useful and significant process. Dose responses (LD_{50}) for each species are different and the growth performance also diverse under certain temperature. However, all strains require similar high, moisture content for fruiting purposes. The mutation induction is involved dose response, irradiation, screening and selection based on its growth performance both at in vitro culture stage and at spawning stage. The selections are rigid and selected fast growing and healthy mycelium strains are tested for seedling performance, spawning and further fruiting ability under adaptation environment. Selected fruiting body with ideal size and high growth performance were chosen for trial plot evaluation. These selected strains are known as potential mutant lines and can be differentiated at genetic level by using ISSR markers in identifying its polymorphism and fingerprint. All these mutant lines are crucial for mushroom sustainability industry in Malaysia.

Keywords: corn grain, sterilisation, variability markers, mutation, gamma radiation, LD_{50}

Costing For Mushroom Bags and Fresh Mushrooms

Mr Nabil Sanusi

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Abstract

Mushroom cultivation or farming often seen as an agricultural field that can provide good income and profits. Sadly, in reality many growers suffered losses and were forced to close their farms. The main challenge in mushroom farming is determining the correct and accurate pricing for bags and fresh mushrooms. Problem arises when mushroom growers do not understand costing system or make detailed cost calculations. What is costing? Costing is the way the grower calculates or works out how much each bag and per kilogram mushroom costs to produce or sell. Costing methods that are suitable for mushroom farming, absorption costing and variable costing. Absorption costing includes all the costs associated with the production of a mushroom bags. While variable costing only includes the variable costs directly incurred in production but not any of the fixed costs. Benefits for growers using a proper cost system are, improved cost control, more useful information for planning and decision making, reasonable and easier inventory measurements, and possible reductions in production costs.

Keywords: cost, mushroom, price

Research, development and commercialisation of mushroom technologies generated by MARDI

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Abstract

Mushroom was regarded as on one of popular food consumed in Malaysia. This fungus enjoying a privilege as high value crop in National Agrofood Policy (2011-2020), This recognition mainly attributed by the nutritional and medicinal properties of this macro-fungi. However, Malaysian mushroom industry suffered with various issues such as inferior and unproductive mushroom strains, insufficient spawn/seeds supply, dwindling supply of rubber sawdust for substrate production, hot weather and short mushroom shelf-life. To address these issues, MARDI emphasises value chain to develop practical technologies that can be benefitted by the Malaysian mushroom industry. A controlled environment cultivation research was embarked for mushroom cultivation in MARDI which generating a better quality mushroom. MARDI developed its own mushroom culture collection where excellent mushroom cultures can be identified through screening. Two excellent strains were shortlisted and were tested in the commercial farms and ready for release by next year. Spawn production technologies in the solid and liquid inoculant were optimised. A mushroom liquid spawn injection system was developed to facilitate the liquid spawn inoculation into sawdust substrate and grains substrate. Once the strains were release, MARDI through its pre-commercialisation activity with private partner will produce mushroom spawns and market it to the farmers. The cultures and spawn production technology will be transferred to the selected spawn producers to ensure sufficient spawn is generated for local farmers usage. Post-harvest technologies were optimised to reduce yield losses and drying technology as strategy to prolong mushroom storage for months was developed. Local mushroom based cosmeceutical products were developed as high value downstream products. Generally, most of the mushroom technologies generated by MARDI in pre-commercialisation stage and ready to be taken by the interested parties only the activity completed.

Keywords: spawn, culture collection, controlled environment cultivation, downstream products

Biofortification of Selenium on *Pleurotus ostreatus* Increase Its Antioxidant Activity and Fruiting Body Formation

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Abstract

Selenium (Se) is a trace mineral which is an essential microelement for precursor of enzyme activity in human's metabolism. However, the availability of Selenium in the food stuff is very low. Edible mushrooms are well known as a good bio accumulator of some dietary mineral. The purpose of this study was to increase Se content of fruiting body of *Pleurotus ostreatus* Jacq. with the addition of various Selenite concentrations on growing medium (0, 50, 75 and 100 mg/L) as well as to analyze the fruiting body formation. The antioxidant activity was determined by β-Carotene/linoleic acid bleaching assay. The result showed that the highest antioxidant activity shown in the fruiting body with addition of 50 mg/L selenite. It is a 2,13%, higher than the Butylated Hydroxy Toluene (BHT) as a positive control of 1.92%. On the other hand, the highest production of fruiting body of 280.87 g was obtained in the addition of selenite of 50 mg/L. The production of fruiting body of 277.98 g and 276.81 g was obtained in the addition of selenite of 75 mg/L and 100 mg/L respectively.

Keywords: Biofortification of Selenium, oyster mushroom, *Pleurotus ostreatus*

IOT-BASED MONITORING SYSTEM FOR OYSTER MUSHROOM UNDER CONTROL ENVIRONMENT

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Abstract

In Malaysia, most farmers depend on traditional agricultural practice. The adaptation of modern agricultural technology plays an important role in improving overall efficiency and productivity. In modern agriculture, the Internet of Things (IoT) connects farmers to their farms through sensors to facilitate monitor of real-time conditions of their farms from anywhere. Oyster mushroom is widely cultivated among farmers in Malaysian. Although this crop is widely consumed and cultivated, it remains overshadowed by traditional cultivation approaches which result in low productivity, high labor efficiency, high cost and effort. The introduction of cooling pad system along with water pump, and exhaust fan ensures that the temperature, humidity, and carbon dioxide will remain in the optimum environment. Cooling pad system was known as one of the most cost-efficient system not only to control room temperature and humidity but also for its almost maintenance free makes it one of affordable choice for sustainability as it can also produce higher cultivation of oyster mushroom up to 2 times higher than conventional method. While this method is so effective, rare cases were reported that the environment parameters is far away from the optimum range such as humidity jump up to 100% during long heavy rain, high carbon dioxide has led to human intervention at to control the environment which led to extra workers just only to be there most of the time. Thus, this study aimed to develop a monitoring system based on IoT on environmental conditions of a mushroom farm, namely temperature, humidity, and light intensity Oyster mushroom requires an optimum temperature between 26°C to 29°C, humidity from 85% to 95% and carbon dioxide not exceeding 600 ppm. Sensors were placed at fixed locations in the farm to measure the parameter status transmitted to remote monitoring station via low-power NodeMCU. The data obtained were stored on the cloud platform. The codes for the controller were written in the Arduino programming language, debugged, compiled and burned into the microcontroller using the Arduino integrated development environment. The results showed the success of monitoring environmental conditions through internet access from anywhere. This approach will reduce human efforts and also help to automate production, which benefits farmers in Malaysia.

Keywords: Oyster mushroom, cooling pad system, IOT-based

Alternative substrates for commercial mushroom cultivation

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With the ongoing climate change, restricted arable land and current pandemic the reality and sustainability of many businesses, particularly agriculture and food production, has drastically changed. In this setting mushroom cultivation is an excellent example of adjustable no-land needed business. Lignocellulosic species can grow on many bio-waste materials and the production can be organized in small spaces, even in urban areas using what is locally available. One such raw material is coffee ground waste obtained from coffee shops, restaurants, bars, and even households. The business can be organized as an integral part of an already existing one, e.g. coffee shop, as an individual, or micro on a household level. In addition, there are other bio-waste materials that previously have been overlooked, like coffee's cascara, cocoa pods, cocoa pulp, different grasses. All these materials contain nutrients adequate for mushroom cultivation. However organized in-depth research is needed to prepare the best cultivation mixes and protocols taking into account biological efficacy, growth speed, yield, and crop quality.

Keywords: alternative substrate, bio-waste materials, coffee ground waste, mushroom cultivation, quality

Abstracts for Oral Presentation

NO 1

Phylogenetic relationships of *Lentinus* sensu stricto (Polyporaceae, Basidiomycota) with emphasis on section Rigidi and Dicholamellatae from Southeast Asia

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Abstract

The present study emphasizes the diversity and phylogenetic relationships of *Lentinus* sensu stricto with an emphasis on *Lentinus* subg. Sect. *Rigidi* and *Dicholamellatae* from the tropics of southeastern Asia, Asia, and Africa. Eighty-four new Internal Transcribed Spacer (ITS) sequences were generated: 66 for sect. *Rigidi* (37 *L. sajor-caju*, 5 *L. polychrous* and 24 *L. squarrosulus*) and 13 for sect. Dicholamellatae. Phylogenetic analysis of 230 *Lentinus/Polyporellus* ITS sequences suggested that *Lentinus* subg. *Lentinus* sensu Pegler of sect. *Rigidi* is paraphyletic. However, sect. Dicholamellatae is strongly supported in both Maximum likelihood and Bayesian methods as monophyletic which is sister group to *Polyporellus* group. Type materials for each species except for *L. squarrosulus*, *L. sajor-caju* and *L. badius* were also evaluated. We propose *Lentinus gayaensis* as new species within the *Lentinus sajor-caju* group with an assignment of *L. sajor-caju* Neotype from Borneo. This species presents as largest lentoid basidiomata that resembles to *L. sajor-caju*, without a fully developed annulus ring, abundant hyphal pegs, cylindrical to ellipsoid basidiospores (4-8 × 2-3 µm), entirely ochraceous when young and totally pink when dry.

Keywords: *Lentinus*, section *Rigidi*, sect. *Dicholamellatae*, Phylogeny

NO 2

Assessment of Inter-Simple Sequence Repeat marker (ISSR) to reveal genetic diversity among *Trichoderma* isolates in Grey Oyster Mushroom Farm

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Abstract

Trichoderma sp. in agricultural industry normally used as biofertilizer to enhance the growth of plant or acts as biological control against plant diseases. However, *Trichoderma* sp. is the main pathogen in causing green mould contamination. Severe contamination could lead to a total loss in mushroom cultivation. In present study, the genetic diversity using inter-simple sequence repeat ISSR marker (ISSR) was assessed among seven *Trichoderma* isolates collected from local grey oyster mushroom farm. A total of 88 loci were detected using seven ISSR primers with average of 12.6 bands per primer. Analysis of dendrogram revealed that similarity coefficient ranged from 0.37 to 0.92. All isolates were clustered into six groups and the principal coordinate analysis were in accordance with UPGMA clustering. In conclusion, ISSR marker can be used to understand the genetic diversity of *Trichoderma* sp.

Keywords: *Trichoderma* sp., similarity coefficient, clustering analysis, principal coordinate analysis

NO 3

The value added 'keropok lekor' with mushrooms

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Abstract

The edible mushrooms (*Pleurotus pulmonarius*), volvareilla mushroom (*Volvareilla spp.*) and splitgill mushroom (*Schizophyllum spp.*) have good nutritional value. This study uses different mushrooms as the functional ingredient of *keropok lekor* because each mushroom also has its distinctive taste and physical properties. The innovation of cendawan keropok lekor, which combines keropok lekor with sliced mushrooms, adds variety to the existing traditional product of keropok lekor, it is a new mushroom – value added products, that can increase the productivity and profitability of the mushroom industry as it can diversify the traditional products of keropok lekor available on the market. The new mushroom-based *keropok lekor* could also help solve the problem of seasonal mushroom dumping for mushroom growers. The study on the processing of *keropok lekor cendawan* has been conducted by MARDI and is ready to be commercialized.

Keywords: keropok lekor, mushrooms, MARDI

NO 4

An Analysis on Nutritional Values and Consumers' Acceptance of *Pleurotus Sajor-Caju* And *Schizophyllum Commune* Mushrooms

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Abstract

Mushrooms are rich in protein, carbohydrates, multivitamins, minerals, and folic acid, making them superfoods. *Pleurotus Sajor-caju* and *Schizophyllum Commune* mushrooms have nutritional values due to their widespread appeal, flavour, and health advantages and have been intensively investigated all around the world. However, the comprehensive studies' data collecting was not thoroughly scrutinised. As a result, the current research was carried out to examine the nutritional values and consumer acceptance of *P. Sajor-caju* and *S. commune.* A methodical search technique was used to locate relevant publications in major databases, such as Scopus, as well as supporting databases, such as Google Scholar. This review examines the nutritional values of *P. Sajor-caju* and *S. Commune* in terms of protein, carbohydrate, fat, moisture, fibre, and ash content, based on the selection and inclusion criteria. Consumer acceptance of *P. Sajor-caju* and *S. Commune* mushroom-based diets was also assessed. This research fills in the gaps left by insufficient critical examinations of nutritional benefits and consumer acceptance of *Pleurotus Sajor-caju* and *Schizophyllum commune* species of mushrooms.

Keywords: *Pleurotus Sajor-caju, Schizophyllum commune,* systematic review, nutritional values, consumers' acceptance

NO 5

Potential of mushroom spent Oil Palm Empty Fruit Bunch (OPEFB) substrate from *Volvariella volvacea* cultivation for renewable energy

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Abstract

The mushroom industry generated high solid waste in the form of spent mushroom compost, about 4-5 kg for each kg of mushroom harvested. In Malaysia, most of the SMC are burnt or dumped on the farm without proper treatment. Zero waste cultivation can become a sustainable solution for SMC management. This study embarked on recycling oil palm empty fruit bunch based SMC from *Volvariella volvacea* cultivation. This biomass's biochemical methane potential (BMP) and calorific value (CV) are investigated. Other analyses such as proximate, compositional and elemental analysis are also studied. A higher amount of methane is measured in SMC samples with improved biodegradability compared to raw pellet, suggesting that subsequent cultivation is a good pre-treatment of the substrate for the anaerobic digestion (AD). CV is highest in a raw pellet (20.57 MJ/kg) comparable to commercial wood pellet but exhibits lower results for SMC samples. Higher ash content due to higher mineral content is reported in SMC. The cellulose composition is reduced to almost 50% during cultivation due to fungal metabolism, which is also evidenced by FTIR analysis. TGA analysis revealed that EFB-based SMC exhibits higher weight loss during combustion than EFB, reducing its thermal properties. SMC of EFB is a high potential biomethane feedstock but not recommended as a fuel pellet.

Keywords: EFB, Volvariella volvacea, straw mushroom, energy

NO 6

Preliminary Study of Alkaline Materials Treatment on Grey Oyster Mushroom (*Pleurotus pulmonarius*) in Spawning and Mushroom Production

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Abstract

Mushrooms are rich and highly nutritious crops that carry numerous medicinal benefits. Despite having medicinal and nutritional benefits, the production of mushrooms in Malaysia to the local demand is still unmet. Several factors are leading to the current landscape of the local mushroom industry include the lack of knowledge on mushroom cultivation, short facility to produce a quality compost; spawn; processed products, and limit of production technology and farm management practices. The most commercially produced mushroom in Malaysia is the grey oyster species (*Pleurotus pulmonarius*). Thus, the present study was conducted to examine the effect of different alkaline materials: gypsum and zeolite, on the efficiency of oyster mushrooms prior to spawning and mushroom production. The spawns were developed on wheat grain treated with alkaline materials of gypsum and zeolite, and where else the spawn without treatment was used as a control. Secondly, the mushroom substrates were formulated into the different compositions comprising sawdust (600g or 300g), rice bran and alkaline materials (zeolite or gypsum) with regard to the standard ratio (100:10:1). The first experiment revealed the alkaline-treated spawns have the shortest number of days taken within 10 days compared to the control (14 days). The spawn from gypsum treatment was observed the thickest in mycelia growth surpassed the other spawn. For the second experiment, the substrate composition from (600g SD + zeolite) garnered the highest yield (62.917g) amidst all the treatments. The number of fruiting bodies produced ranged between 2.67 to 4, however, it noticeably showed no significant changes. The application of gypsum and zeolite in a combination of an ample substrate formulation might be practical for a better quality of spawn and higher yield of mushroom.

Keywords: zeolite, spawn, sawdust

NO 7

Crucial steps in preparing substrate seedlings for paddy straw mushroom (*Volvariella volvacea*) Cultivation

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Abstract

Paddy straw mushroom or *Volvariella volvacea* is a commercial edible mushroom cultivated in Malaysia. In mushroom cultivation, seedlings are the most important materials for growing mushrooms. The mushroom seedlings are referred to mother culture (in semi solid PDA), grain seedling and substrate seedling. A substrate seedling for paddy straw mushroom consists of kekabu, limestone and dried agrowaste. It is important to understand and identify common hitch and mistakes in preparing the substrate seedlings for quality and high-performance mycelium growth. Basically, the process in preparing substrate seedling for *Volvariella volvacea* are substantial mixing, composting, packaging and sterilization. In mixing, kekabu and agrowaste must be in dried condition. Agrowaste should be chopped at size 0.5 – 1 cm and soak for 24 to 48 hours. Whereas, kekabu should be shredded accordingly prior to mix evenly with the soaked agrowaste. The ratios normally 1:1 and moisture content ranged between 65-70%. Precaution must be taken for dried materials and soaking process. Both are contributing to fungus contaminations. Composting for 24-48h is important for degradation process and improved nutrient uptake by mycelium during spawning. Besides, tossing prior mixing is also crucial in governing water content in the substrate seedling. Transparent Polypropylene plastic beg (6 x 15 cm) with thickness ranging between 0.03 to 0.05 mm are commonly used which can stand hot temperature during pasteurize or autoclaved process. In reducing risk of contamination. the substrate seedlings require to be sterilized by autoclaving at 121°C, 15 psi for 15 to 20 minutes or steam pasteurizing ranging from 70-100℃ for an hour. It is important to gradually cooling down the substrate seedling in minimize water vapor inside the begs which could trigger the contamination both from fungus and/or bacterial. Starting date for the substrate seedlings towards expiry date can be count after the substrate seedling was removed from the sterilization chamber. High quality substrate seedling is depending on the mentioned process and ways in handling the materials also play roles for commercial production of the substrate seedlings. Understanding the process promptly is expected to support mushroom industry towards more activities in *Volvariella* mushroom cultivation.

Keywords: paddy straw mushroom, substrate seedlings, *Volvariella volvacea*

NO 8

Landless Mushroom Cultivation via Fabricated-Bioreactor Systems for efficient Biomass and Beta-glucan Production

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Abstract

To enhance the mycelium biomass yield and exopolysaccharide (EPS) productivity of *Ganoderma lucidum* strain QRS 5120, the interaction between initial pH, glucose concentration, agitation and aeration was investigate using Response Surface Methodology (RSM) in a fabricated bioreactor (Air-L-shape Bioreactor; ALSB). A central composite design (CCD) was applied and a polynomial regression model with quadratic term was used to analyse the experimental data using analysis of variance (ANOVA). ANOVA analysis showed that model was very significant for mycelium biomass ($p < 0.0001$) and for EPS ($p < 0.0001$). Agitation and aeration showed the strongest effect ($p < 0.0001$) for mycelium biomass, meanwhile glucose showed significant effect ($p < 0.0048$). On the other hand, glucose and initial pH showed strongest effect ($p < 0.0001$) on EPS production. The estimated optimum conditions of the variables to produce highest mycelium biomass and EPS concentration by *Ganoderma lucidum* strain QRS 5120 are as follow: initial pH 5.7, glucose concentration 24 g/L, agitation at 111 rpm and aeration at 2.96 v/v and initial pH 4.03, glucose concentration at 29.9 ≈ 30 g/L, agitation at 87 rpm and aeration at 2.66 v/v respectively. The model was validated by applying the optimized conditions; (ALSB: 8.2 ± 0.5 g/L of mycelium biomass and 4.61 ± 0.8 g/L EPS concentration) and (shake flask: 5.13 ± 0.3 g/L of mycelium biomass and 2.64 ± 0.6 g/L of EPS) were obtained. The optimised conditions showed significant increment in mycelium biomass and EPS. Therefore, the fabricated bioreactor (ALSB) showed enhancement in fungal liquid fermentation than shake flask fungal liquid fermentation.

Keywords: exopolysaccharide (EPS), *Ganoderma lucidum* strain QRS 5120, glucose concentration, Response Surface Methodology (RSM)

NO 9

Oyster mushroom (*Pleurotus ostreatus*) cultivation on different food waste originated substrates

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Abstract

Oyster mushroom (*Pleurotus ostreatus*) was cultivated on seven substrate mixtures, containing grape pomace, soybean husk and sunflower seed husk, which represent the wastes from the wine and edible oil industry. Wheat straw was used as a control substrate. Grape pomace mixtures and control substrate were grown under higher ambient temperature than soybean and sunflower husk mixtures. The effect of food industry waste-based substrates on several productivity parameters (time required for completion of mycelium running (days), mycelium running rate in bags (mm/days), time required for primordia initiation (days), time required for harvesting (days), total mushroom yield and biological efficiency) was estimated. Results indicated soybean husk affecting the best mushroom yield and biological efficiency, followed by sunflower seed husk substrates and wheat straw as a control substrate. Grape pomace-based substrates showed the lowest productivity potential. On the other hand, lower cultivation temperatures showed slower growth causing the longer time from inoculation to harvest. To complete the estimation of these alternative raw materials for mushroom cultivation future research may include the assessment of the chemical and antioxidant properties of mushrooms as well as their quality characteristics.

Keywords: *Pleurotus ostreatus*, mushroom, cultivation, substrate, food waste

Abstracts for Poster Presentation

NO 10

Oyster Mushroom Nutrition Facts and Health Benefits

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Abstract

The oyster mushroom is a common type of edible mushroom. The fungi got their name because they have a shape and color similar to an oyster. They are often consumed as a food, but oyster mushroom supplements are also available. In certain systems of medicine, such as traditional Chinese medicine (TCM), oyster mushrooms are used to treat a variety of health conditions. Oyster mushrooms provide dietary fiber, beta-glucan, and other ingredients that may boost health. They have a delicate taste and can be used to add flavor to a wide variety of savory dishes. They can easily be found in most grocery stores, making them a convenient, nutritious addition to your diet. One cup of raw, sliced oyster mushrooms (86g) provides 28 calories, 2.9g of protein, 5.2g of carbohydrates, and 0.3g of fat. Oyster mushrooms are an excellent source of niacin, fiber, and riboflavin. This nutrition information is provided by the (United States Department of Agriculture) USDA. Oyster mushrooms contain several substances thought to influence health. These substances include dietary fiber, beta-glucan, and several other polysaccharides—a class of carbohydrates affecting immune function. Scientific studies on the health benefits of oyster mushrooms are emerging.

Keywords: Oyster mushroom beta-glucan, dietry fiber

NO 11

Utilization of spent mushroom substrates

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Abstract

According to the Food and Agriculture Organization (FAO), in 2014, Asian countries produced more than 74.64% of world mushroom markets, followed by Europe 19.63%. Based on the percentage mentioned, the mushroom industries must produce a lot of waste by dumping in landfills and open field burning, both of which contribute to serious environmental degradation such as global warming, harming flora and fauna and also affecting human health. Waste product that produces after harvesting the mushroom known as spent mushroom substrates (SMS). However, from 1 kg of mushroom production, approximately 5 kg of SMS will be produced. Saw dust, wheat straw, paddy straw, cotton seed hulls and others are a part of the ingredients for the substrate and due to their composition of nutrient, moisture and energy, this will allow the growth and development of mycelium. Nowadays, there is always a demand for finding a cost-effective waste management solution due to the disposal challenge. In most cases, they are disposed of through incineration, which affects the environment. The utilization of SMS can be reused and value-added in other processes such as compost, bio-compost, biofertilizers, animal feeds and bioremediation. Waste management of SMS can be the best opportunity and can be utilized in a better way to save the earth from being polluted little by little

Keywords: spent mushroom substrates (SMS), saw dust, wheat straw, paddy straw, cotton seed hulls

NO 12

Foresight of growth media for in vitro propagation in edible mushroom

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Abstract

Mushrooms have gained a name in the commercial industry and have grown all over the world today. Therefore, in order to maintain a continuous production of mushrooms, propagation is the initial step to transferring the mycelium from one mushroom to another to keep it going. The propagation process began with media preparation to grow the mycelium in a petri dish from a fruiting body under a sterile environment. Potato dextrose agar (PDA)) are commonly used media that contains dextrose as a carbohydrate source as a growth stimulant and provide a nutrient base to most fungi. However, using water hyacinth and yam are other sources that are derived from nature as an alternative medium to increase more production with the lower cost. Yam can be utilized as an effective medium for propagation as it belongs to starch-rich and energy rich tubers as potatoes. It also can increase the economic value to the growers when the utilization of the yam expands. Water hyacinth is attractive in rivers and lakes because of its ability to quadruple biomass quickly and make it listed among the 100 worst invasive plants in the world. Since it will be a threat to lake activities with its rapid growth, the ideal to make it as a medium in mushroom propagation can reduce the risk. Moreover, dry hyacinth also can be used to assist mushroom farming, replacing the requirement for costly bagasse, sawdust, and sugarcane leaves as a substrate. So these works performed will give a good production during mushroom propagation and cultivation which helps to meet mushroom demand. Keywords: propagation, water hyacinth, potato dextrose agar (PDA), alternative media

Keywords: mushrooms, propagation, mycelium, media

NO 13

Contamination from nature in local edible mushrooms during in vitro culture propagation

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Abstract

High nutritional value such as protein and minerals in cultivated edible mushrooms significantly contribute to high demand for their productions in agriculture industries. This contribution resulted in farmers facing significant obstacles due to diseases. The productivity of commercial mushroom farming can be severely harmed by disease outbreaks. There are several types of locally cultivated edible mushroom such as oyster mushroom, straw mushroom, cloud ear fungus and splitgill mushroom. Diseases in edible mushrooms such as bacterial yellowing, brown blotch, green mold and brown spots are caused by bacteria, fungus and viruses usually occurring in these types of mushroom. For instance, *Pseudomonas agarici* can cause yellow discoloration of the pileus in *Pleurotus* spp while Trichoderma spp. are the causative agents of green mold disease that can be observed by the sporulation of green fungal spores in the oyster mushroom substrates. Furthermore, brown spot diseases from *Gliocladium roseum* can cause shrinking of fruiting bodies and brown spots in the tissues of mushrooms. Some fungal and bacterial infections commonly affect intensive cultivations of edible mushrooms, resulting in substantial yield losses. The high temperatures, humidity, carbon dioxide (CO_2) and oxygen (O_2) levels and lighting in mushroom cultivation facilitate these diseases in mushroom media. Even though proper farm management and extreme hygiene can help avoid severe outbreaks, certain diseases are particularly difficult to eradicate. Farm management and suitable environment needs to be sustained in order to secure the production of mushrooms. It is important to understand the common disease in mushroom cultivation in order to avoid any further complications faced by the growers.

Keywords: Edible mushroom, Mushroom diseases, Virus, Fungus, Bacteria

NO 14

Bongkah penanaman cendawan komersial bagi kemantapan pertumbuhan miselium

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Abstrak

Cendawan tiram sesuai ditanam menggunakan blok substrat berasaskan habuk kayu getah. Campuran habuk kayu getah akan dicampuran dengan dedak padi dan kapur pada perkadaran 100:10:1. Campuran substrat ini digaulkan dengan air bersih yang bertapis bagi memberikan kelembapan antara 65-70%. Bongkah substrat cendawan seberat antara 600-700 g. Substrat bongkah cendawan ini akan di pasturkan menggunakan pengukus gas selama 8 jam dengan memastikan suhu berada pada tahan 80-90℃ selama 3-4 jam. Setelah selesai proses pengukusan, bongkah cendawan yang telah dikukus dikeluarkan dari pengukus diletakkan ke dalam rumah benih untuk disejukkan selama 12 jam dan setelah sejuk barulah bongkah diinokulasikan dengan benih cendawan berasaskan bijirin (5g). Bongkah cendawan yang telah diinokulasikan ini akan diperam pada suhu rumah pemeraman antara 26-28℃ dengan kelembapan di dalam rumah peram antara 60-70%. Pertumbuhan miselium akan mencapai kematangan antara 40-50 hari. Bongkah cendawan matang ini akan dipindahkan ke rumah tuai bagi penuaian jasad buah. Jasad buah akan keluar antara 3-4 dari bongkah yang sama dan proses ini mengambil masa selama 3-4 bulan dalam keadaan kawalan tempoh masa rehat miselium. Anggaran jasad buah yang keluar ialah di antara 80-170g dengan purata berat jasad buah 130g/bongkah/kitaran (15,000 bongkah). Penuaian hasil cendawan bergantung kepada kualiti bongkah cendawan yang digunakan bagi mendapatkan hasil pengeluaran cendawan yang tinggi. Di samping itu penyelengaraan bongkah yang sistematik dirumah hasil juga turut berperanan memberikan pulangan hasil cendawan yang baik dan berkualiti.

Keywords: biji jagung, sterilisasi, pastur, rumah tuai, rumah peram

NO 15

Review On Nutritional Composition, Medicinal Properties of Edible Mushrooms And Potential Valorisation Of Mushroom Waste Product As Functional Food Product Development

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Abstract

Edible mushroom productions have increased in recent years around the world however, the amount of mushroom wastes disposed by the mushroom industry have also increased tremendously. This study reviews the nutritional and medicinal properties of edible mushrooms, and the potential utilisation of mushroom waste (stem and fruiting body base) as a potential ingredient in food products. The incorporation of fruiting body base (FBB) flour of *P. sajor-caju* into chicken patty (10%, 20% and 30%), steamed buns (10%, 20% and 30%) and cookies (10% and 20%), affects the colour, texture and sensory attributes. Only 10% of fruiting body base (FBB) flour considered acceptable and suitable to be substituted chicken patty, steamed bun and cookies. Meanwhile, incorporation of the enoki mushroom (*F. velutipes*) stem waste in goat meat nuggets (2%, 4% and 6%) improved the emulsion stability, reduced the expressible water and cooking loss, and also prevented lipid oxidation during storage the goat meat nuggets. It can be suggested that 4.0% enoki mushroom stem waste is suitable to be employed as an added functional ingredient in the goat meat nuggets. Overall, edible mushrooms have high nutritional and medicinal benefits, and mushroom wastes have the potential to be used as a useful component in the food products. Furthermore, valorisation of mushroom waste is in line with UN's Sustainable Development Goals that contributes toward global food security.

Keywords: Edible mushroom, mushroom waste, antioxidant, enoki mushroom, *Pleurotus sajor-caju*

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PERALATAN PENGUSAHA CENDAWAN

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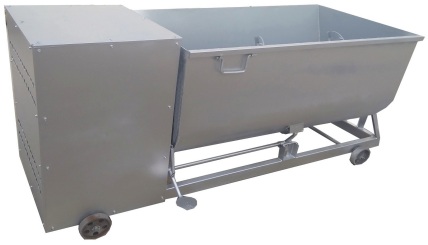

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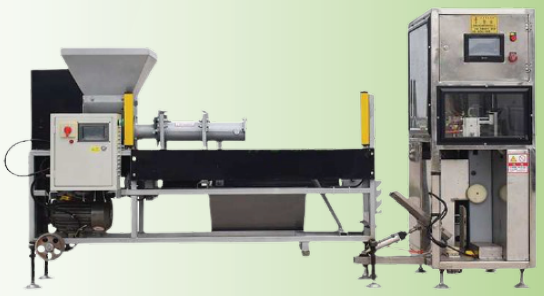

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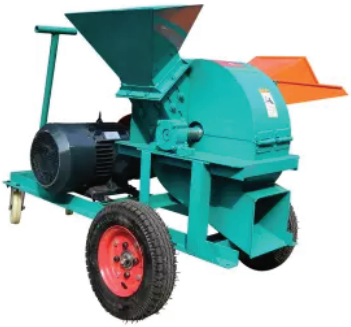
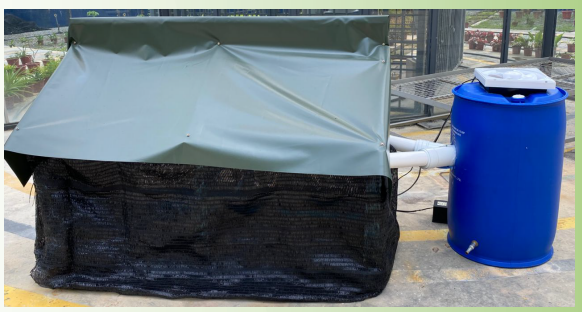


STEAMER (KUKUSAN) UNTUK SUBSTRATE CENDAWAN

LAMINAR FLOW (TISSUE CULTURE)

RUMAH CENDAWAN KAWALAN IKLIM



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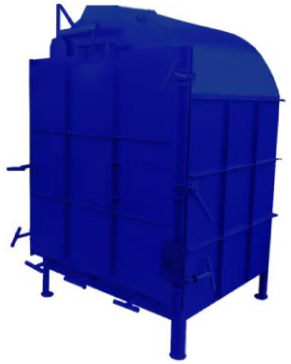

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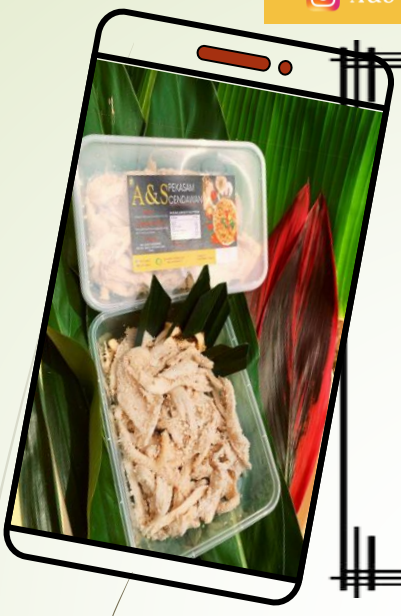

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