EVALUATION OF MOTHER SPAWN PRODUCTION OF *Volvariella volvacea* (PADDY STRAW) MUSHROOM ON DIFFERENT SUBSTRATE FOR RAPID MYCELIUM GROWTH RATE

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by

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APPROVAL AND DECLARATION SHEET

This project report titled Evaluation of Mother Spawn Production of *Volvariella volvacea* (Paddy Straw) Mushroom on Different Substrate for Rapid Mycelium Growth was prepared and submitted by Cheng Weei Kai (Matrix Number: 141282450) and has been found satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the Bachelor of Chemical Engineering Technology (Industrial Biotechnology) in Universiti Malaysia Perlis (UniMAP).

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PENILAIAN TERHADAP PERLBAGAI SUBSTRAT UNTUK MENINGKATKAN KADAR PERTUMBUHAN MISELIUM CENDAWAN JERAMI PADI (*Volvariella volvacea*) DALAM PENGELUARAN BENIH INDUK

ABSTRAK

Benih induk merupakan sumber penting dalam mendorong pertumbuhan cendawan jerami yang mempunyai impak yang signifikan kepada produktiviti dari segi kuantiti dan kualiti. Kajian ini bertujuan untuk menilai substrat yang paling sesuai untuk menghasilkan pertumbuhan miselium cendawan jerami yang cepat. Ekstrak Malt Agar (MEA) menghasilkan pertumbuhan miselium cendawan jerami yang paling pantas berbanding dengan Agar Dekstrosa Kentang dan Nutrien Agar. Secara umumnya, pertumbuhan miselium dalam MEA adalah 2 hari lebih pantas daripada PDA dan NA langsung tiada miselium. Selain itu, habuk kayu getah dijumpai menghasilkan pertumbuhan miselium yang paling pantas apabila dibandingkan dengan pertumbuhan miselium padi, jerami padi, habuk kayu getah (RSD), tandan buah kosong kelapa sawit (EFB) dan EFB kompos. Justeru itu, dengan menggunakan parameter daripada jurnal, habuk kayu getah bersama dengan parameter suhu, dedak padi dan kalsium karbonat digunakan untuk menjalankan kajian pengoptimuman dengan reka bentuk "Box-Behnken Design (BBD) dalam "Response Surface Methodology" (RSM). Selepas menjalankan kajian pengoptimuman, kondisi optimum bagi menghasilkan pertumbuhan miselium yang paling pantas dalam substrat habuk kayu getah adalah 34 ˚C, 0.5 g dedak padi dan 0.07 g kalsium karbonat. Satu lagi kajian pengesahan telah dijalankan bagi mengesahkan kondisi yang dicadangkan oleh BBD dan didapati bahawa jumlah tempoh bagi miselium *V. volvacea* untuk memenuhi substrat habuk kayu getah adalah 5.82 hari berbanding dengan nilai yang dianggarkan 5.89 hari. Ralat yang kecil menunjukkan bahawa model ini sesuai untuk digunakan dalam pengoptimuman jumlah tempoh bagi miselium *V. volvacea* untuk mempenuhi substrat habuk kayu getah. Jumlah kandungan lignoselulosa jerami padi didapati mengandungi 11.87 % extraktif, 20.84 % hemiselulosa, 34.12 % selulosa, 10.58 % lignin and 22.51 % abu dan miselium *V. volvacea* .dijumpai memenuhi

substrat jerami padi dalam masa 10 hari, manakala substrat tandan buah kosong kelapa sawit memenuhi substrat jerami padi dalam masa 12 hari. Keputusan yang diperolehi daripada kajian tersebut menunjukkan bahawa substrat habuk kayu getah sesuai untuk digunakan untuk menghasilkan miselium *V. volvacea* yang cepat.

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ABSTRACT

Mother spawn production is an essential source for the development of mycelium growth which will lead to the productivity of the fruiting body of straw mushroom in both quantity and quality. This study aimed to evaluate which substrates produces rapid mycelium growth rate of straw mushroom. Malt Extract Agar (MEA) was found to produce the fastest *V. volvacea* mycelium as compared to Potato Dextrose Agar (PDA) and Nutrient Agar (NA). Generally, the mycelium growth of straw mushroom in MEA was 2 days faster than PDA, while NA has no growth of mycelium at all. By comparing the mycelium growth rate of paddy rice, paddy straw (PS), rubber wood sawdust (RSD), non-composted empty fruit bunches (EFB) and composted EFB, RSD was found to produce rapid mycelium growth rate. Thus, optimization of RSD with the parameters temperature, amount of rice bran and calcium carbonate ($CaCO_3$) was carried out using Box-Behnken design (BBD) of Response Surface Methodology (RSM). The optimum conditions obtained after optimisation studies depicts that at 34 ˚C, 0.5 g rice bran and 0.07 g of $CaCO_3$. The solution of validation test obtained from experiment was close to the predicted value given by BBD with days taken for *V. volvacea* mycelium fully colonization on RSD substrate of 5.82 days versus predicted value of 5.89 days. The error was small thus the model was suitable to use for the optimization of Days taken for *V. volvacea* mycelium fully colonization on RSD substrate. The total lignocellulosic of paddy straw was found to be 11.87 % extractives, 20.84 % hemicellulose, 34.12 % cellulose, 10.58 % lignin and 22.51 % ash and , it was found out that the total days taken for *V. volvacea* mycelium to fully colonize the substrate paddy straw in “bongkah” was 10 days while for non-composted EFB was 12 days. The result attained from this study shows that rubber wood sawdust has the potential to become the alternative substrate to produce rapid mycelium growth.

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LIST OF SYMBOLS

A_d	Ash
cm	Centimeter
$\frac{cm}{Day}$	Centimeter per Da
˚C	Degree Celcius
$\frac{^{\circ}C}{min}$	Degree Celcius per minute
g	Gram
$\frac{g}{L}$	Gram per Liter
kg	Kilogram
k_r	Radial Growth of Mycelium Linear Expansion Rate
k_t	Mycelium Growth Rate
m	Meter
min	Minutes
mL	Milliliter
mm	Millimeter
$\frac{mm}{h}$	Millimeter per Hour
%	Percentage
R, W	Radius of the Radial Growth of Mycelium Extension
t_d	Doubling time
x	Time
y	Distance
μ_w	Mycelium Specific Growth Rate

LIST OF ABBREVIATIONS AND NOMENCLATURE

ANNOVA	Analysis of Variance
Atm	Atmospheric Pressure
BBD	Box-Behnken Design
$CaCO_3$	Calcium Carbonate
C:N	Carbon to Nitrogen
DoE	Design of Experiment
EFB	Empty Fruit Bunches
F-Value	Fisher Value
GRT	Glass Race Tube
H_2SO_4	Sulphuric Acid
ME	Malt Extract
MEA	Malt Extract Agar
NA	Nutrient Agar
Na^+	Sulfate Ion
NaOH	Sodium Hydroxide
PS	Paddy Straw
R^2	Correlation Coefficient
R-squared	Determination of Coefficient
RSD	Rubber Wood Sawdust
RSM	Response Surface Methodology
SEA	South East Asia
V. volvacea	*Volvariella volvacea*