

COLONIZATION OF *GANODERMA LUCIDUM* ON
SOYBEANS SUBSTRATE FOR TEMPEH
DEVELOPMENT

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APPROVAL AND DECLARATION SHEET

This project report titled Colonization of *Ganoderma lucidum* on soybeans substrate for Tempeh development was prepared and submitted by Goh Ie Vonne (Matrix Number: 141282454) 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 (Honours) (Industrial Biotechnology) in Universiti Malaysia Perlis (UniMAP).

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KOLONISASI *GANODERMA LUCIDUM* ATAS SUBSTRAT KACANG SOYA UNTUK PEMBENTUKAN TEMPEH

ABSTRAK

Aplikasi miselium *Ganoderma lucidum* telah digunakan sebagai inoculum untuk tujuan mengkaji kebolehannya membentuk tempeh melalui fermentasi secara keadaan pepejal atas substrat kacang soya. Miselium *G. lucidum* mempunyai kemampuan yang sama dengan miselium *Rhizopus oligosporus* untuk menjajah kacang soya menjadi tempeh yang padat. Model linear telah digunakan dengan fasa log sebagai rujukan, di mana pertumbuhan miselium meningkat secara linear terhadap masa inkubasi. Kadar pertumbuhan miselium *G. lucidum* atas substrat kacang soya ialah 10.803 cm²/hari atau 1.293 cm/hari. Kandungan nutrisi bagi tempeh yang tertapai menggunakan miselium *Ganoderma lucidum* telah dinilai, termasuklah ujian Phenol-sulfurik asid untuk analisis karbohidrat, pengekstrakan Soxhlet untuk analisis lipid dan ujian Bradford untuk analisis protein. Daripada penentuan kandungan nutrisi dalam kajian ini, kedua-dua Tempeh *Ganoderma* dan Tempeh Kawalan mempunyai kandungan protein yang lebih tinggi dibandingkan dengan kandungan karbohidrat dan lipid. Walau bagaimanapun, Tempeh *Ganoderma* telah menunjukkan kandungan yang memuaskan dalam analisis pemakanan. Berdasarkan 100 g tempeh, Tempeh *Ganoderma* didapati mempunyai protein 56.7 ± 0.0062 g, karbohidrat 17.1 ± 0.078 g dan lipid 10.4 g. Sebaliknya, kandungan protein, karbohidrat dan lipid dalam Tempeh Kawalan masing-masing adalah 20.8 ± 0.0058 g, 16.6 ± 0.0385 g dan 14 g. Berdasarkan hasil yang diperoleh dari kajian ini, Tempeh *Ganoderma* mempunyai potensi untuk dikomersilkan sebagai tempeh yang bernilai tambah dengan aplikasi *G. lucidum* mycelium.

ABSTRACT

The application of *Ganoderma lucidum* mycelium was employed as the inoculum in order to study the possibility of developing tempeh by solid state fermentation on soybeans substrate. The *G. lucidum* mycelium has the same capability with the *Rhizopus oligosporus* mycelium to colonize the soybeans into a compact tempeh. Linear model was applied with the log phase as reference, in which the mycelium growth increases linearly as a function of incubation time. The mycelial growth rate of *G. lucidum* on soybeans substrate has a value of 10.803 cm²/day or 1.293 cm/day. The nutritional content of fermented tempeh using *G. lucidum* mycelium was evaluated includes Phenol-sulfuric acid method for carbohydrate analysis, Soxhlet extraction for lipid analysis and Bradford test for protein analysis. From the nutritional content determination in this study, both *Ganoderma* Tempeh and Control Tempeh has a higher protein content in comparison to carbohydrates and lipid contents. However, the *Ganoderma* Tempeh has showed a satisfactory content in the nutritional analysis. In the basis of 100 g of tempeh, it was revealed that *Ganoderma* Tempeh has 56.7 ± 0.0062 g proteins, 17.1 ± 0.078 g carbohydrates and 10.4 g lipid. On the other hand, the contents of proteins, carbohydrates and lipid in Control Tempeh are 20.8 ± 0.0058 g, 16.6 ± 0.0385 g and 14 g, respectively. Based on the result obtained from this present study, the *Ganoderma* Tempeh has the potential to be commercialized as a value-added tempeh with the application of *G. lucidum* mycelium.

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LIST OF SYMBOLS

\$	US Dollar
kg	kilogram
mL	milliliter
cm	centimetre
cm ²	square centimetre
g	gram
°C	Celcius
pH	potential of hydrogen
kPa	kilopascal
mg	milligram
M	molarity
Nm	nanometer
π	pie
r	radius
%	percentage

LIST OF ABBREVIATIONS OR NOMENCLATURE

PDA	Potato dextrose agar
RM	Ringgit Malaysia
AD	anno Domini
SSF	Solid state fermentation
C/N	Carbon-to-nitrogen ratio
BSA	Bovine serum albumin
HCl	Hydrochloric acid
US	United State
UV	Ultraviolet
HPLC	High performance liquid chromatography
TLC	Thin liquid chromatography