EFFECT OF VARIOUS MEDIA ON THE GROWTH OF *Pleurotus ostreatus*

NOOR SHIREEN

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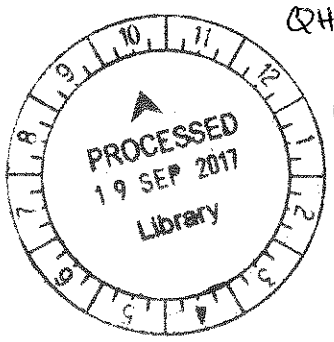

FACULTY OF HEALTH AND LIFE SCIENCE
INTI INTERNATIONAL UNIVERSITY
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ABSTRACT

Cultivation of *Pleurotus ostreatus* (Oyster Mushroom) on different type of media substrate was being conducted in this study. The reason for this study is to determine the effectiveness of various types of media on the growth of *P. ostreatus*. Total of 13 media treatment were being tested on the growth of *P. ostreatus*. Three of the media used were based on the different concentration of Potato Dextrose Agar (PDA) which was full strength, half strength and quarter strength PDA respectively. Four of the treatments were based on agar type of media. One medium was prepared with agar only and another three were prepared with 10% milk, 10% coconut milk and 10% urea, respectively. Six type of organic waste media were tested along which were rice bran, coconut waste, coffee waste, tea waste, saw dust and combination of saw dust and rice bran. The growth of the mycelium over the media substrate was recorded daily by measuring the size of the mycelium growth in mm towards the edge and bottom of the container. Based on the 20 days daily observation, rice bran medium appeared to be the best treatment for organic substrate medium used while agar with coconut milk medium shows the best treatment for agar type of media used. The second, third and fourth best media for agar type of media are full strength PDA medium, half strength PDA medium and agar with milk medium respectively. On the other hand, the second best media for organic substrate is tea waste medium, third best media is coconut waste medium and fourth best media for organic substrate media is saw dust medium. Coffee ground medium shows the least favorable media for growth of *P. ostreatus* as an organic substrate media while agar with urea show negative result in the growth of *P. ostreatus* as agar type of media due of the inappropriate concentration of urea used. Overall, rice bran medium show the best media for the growth of *P. ostreatus* by producing fruiting body on day 13 while agar and coconut milk medium is the second best media used by producing fruiting body on day 15 of the observation.

LIST OF ABBREVIATIONS

1/2PDAE	Half strength PDA medium, mycelium grew towards edge
1/4PDAE	Quarter strength PDA medium, mycelium grew towards edge
1PDAE	Full strength PDA, mycelium grew towards edge
ACME	Agar with coconut milk medium, mycelium grew towards edge
AE	Agar medium, mycelium grew towards edge
AME	Agar with milk medium, mycelium grew towards edge
AUE	Agar with urea medium, mycelium grew towards edge
COB	Coconut waste medium, mycelium grew towards bottom
COE	Coconut waste medium, mycelium grew towards edge
COFB	Coffee ground medium, mycelium grew towards bottom
COFE	Coffee ground medium, mycelium grew towards edge
g	Gram
L	Liter
mL	Milliliter
PDA	Potato Dextrose Agar
RBB	Rice bran medium, mycelium grew towards bottom
RBE	Rice bran medium, mycelium grew towards edge
SDB	Sawdust medium, mycelium grew towards bottom
SDE	Sawdust medium, mycelium grew towards edge
SDRBB	Sawdust and rice bran medium, mycelium grew towards bottom
SDRBE	Sawdust with rice bran medium, mycelium grew towards edge
TEAB	Tea medium, mycelium grew towards bottom
TEAE	Tea medium, mycelium grew towards edge

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENT

CHAPTER 1

INTRODUCTION

Pleurotus ostreatus or also known as oyster mushroom is said to be the most suitable fungus in order to produce food high in protein from numerous agricultural waste without composting (Oyster Mushroom Cultivation, 2016). Generally, oyster mushrooms are being cultivated in over 25 countries including Europe, Asia and America. Italy, Japan, Philippines, South Korea, Thailand and Taiwan are the main countries which produce oyster mushroom (Oyster Mushroom Cultivation, 2016).

Normally, up to $800 million of profit were gain each year by the mushroom farmers in America only (Kuo, 2004). The international mushroom cultivation has enormously improved, as it raised the production from around 0.3 million loads in 1961 to roughly 3.41 million loads in 2010 (Adjapong, Ansah, Angfaarabung, & Sintim, 2015). The leading mushroom producer globally is China as it produces about 65% of worldwide mushroom and the production of oyster mushroom only in China is about 85% globally. Country like Africa only produces 1% of oyster mushroom for the entire world yield (Adjapong et al., 2015).

Oyster mushroom production is a profitable yet competitive business. The key component in mushroom cultivation is the substrate. The substrate chosen must be appropriate and effective for the growing and fruiting of the fungus. On top of that, the substrate chosen should be obtainable nearby in maintainable amount and at low budget such as tree stumps and logs (Tisdale, Miyasaka, Habte, & Hemmes, 2004).

For the cultivation of this oyster mushroom, normally shredded straw or sometimes hardwood logs which are freshly cut are used (Sayner, 2012). Somehow, both of these media have their downfalls as they take a long time for the mushroom to be grown. Moreover, the straw has to be pasteurized first to get rid of any unwanted microorganisms that compete with the growing mycelium (Sayner, 2012). This problem could be avoided, for instance,

using a fresh coffee ground since the coffee has already being pasteurized earlier during the brewing process. Besides, coffee ground is an enormous waste resource and it is loaded with nutrient which will give maximum benefits for the growing mushroom (Sayner, 2012). To date, there is no report on using coconut milk, milk and coconut waste to cultivate oyster mushroom.

The objective of this experiment is to determine the effectiveness of various media namely full strength, half strength, quarter strength PDA media, agar only, agar with 10% milk, agar with 10% coconut milk, agar with 10% urea, rice bran, coconut waste, coffee waste, tea waste, saw dust and combination of saw dust and rice bran on the growth of oyster mushroom, *P. ostreatus.*

The null hypothesis for this study is that there is no significant difference among the entire media tested and the alternative hypothesis for this study is that there is a significant difference among the entire media tested.

CHAPTER 2

LITERATURE REVIEW

2.1 *Pluerotus ostreatus* (Oyster Mushroom)

Dutch botanist Nikolaus Joseph Freiherr von Jacquin was the first to term Oyster Mushroom scientifically back in 1775 giving it the name *Agaricus ostreatus.* This is so because in the initial existences of fungus taxonomy, almost all the gilled mushrooms were grouped under the genus *Agaricus.* Oyster mushroom was then reassigned under the genus *Pleurotus* by a German mycologist Paul Kummer back in 1871. This novel genus was demarcated by Kummer himself in 1971 and currently accepted scientific name (O'Reilly, 2011).

The name of the genus '*Pleurotus'* originated from the Greek word which is '*Pleuro*' carrying the meaning of laterally formed or lateral position of the mushroom stem (Oyster Mushroom Cultivation, 2016). *Pleurotus ostreatus* or oyster mushroom is considered the second largest cultivated mushroom in the world after *Agaricus* mushroom. Besides, it is also a vital edible mushroom in the global marketplace (Adjapong, Ansah, Angfaarabung, & Sintim, 2015).

Oyster mushroom is basidiomycetes and it is a lignocellulolytic fungus which is well known for its extensive range of substrate compatibility since it can thrive in various substrate for its growth, besides having slightly nutty with oyster like flavor when heated ("Encyclopedia of Life", 2016). In the wild, it grows on decaying wood logs as well as dry trunks ("Oyster Mushroom Cultivation", 2016). Somehow, the cultivation only started in the early 1900's. Earlier method of *P. ostreatus* cultivation uses logs and tree stumps as substrate to mimic the mushroom growth in the wild (Tisdale, Miyasaka, Habte, & Hemmes, 2004). When an attempt to grow *P. ostreatus* on sawdust in Germany back in 1950's was fruitful, it became a significant breakthrough for cultivation of mushrooms. In 1960's, a mass

production of *P. ostreatus* first began using a straw based substrate. Ever since, the manufacture and approval of *P. ostreatus* has been increasing (Tisdale et al., 2004). Depending on countries we are living in, for example, in the US, wheat straw is commonly used as substrate meanwhile in China due the abundance of rice straw available, it is used as substrate. Cotton waste, peanut shells, corn cobs, tea waste and palm fronds are some substrate which has been used effectively (Tisdale et al., 2004).

P. ostreatus was tested to have a large scoop of non-consumable usage from mycoremediation to therapeutic uses. Throughout Europe, Asia, America, Australia as well as Northern Africa, *P. ostreatus* is a prevalent fungus known as white-rot ("Encyclopedia of Life", 2016). *P. ostreatus* can be a facultative parasite on a strained host even though it is mainly saprophytic. Sporophytes can be found growing naturally on both the living as well as dead tree of conifers or broadleaf hardwood. Within this species, many other different variations or strains as well as subspecies could be found however, there are two main ecotypes available which is the blue brown from Europe and the brown from North America ("Encyclopedia of Life", 2016).

2.1.1 Morphology

Being characterized by 4-20 cm of oyster or fan shaped cap, the caps assorted from arched to flat or funnel shaped with smooth exterior. *P. ostreatus* are extremely varies in color usually having grayish brown, white, dark brown or tanned and this color may later on turn to yellowish as it gets older. The fruiting bodies of *P. ostreatus* are about 20 cm in size which is considered to be fairly big ("Encyclopedia of Life", 2016). The shade of sporophores is influenced by the intensity of light, temperature as well as the nutrient containing in the substrate. Some other color of sporo-carps can be found such as pink or blue but these are less common ("Encyclopedia of Life", 2016). The flesh of P. ostreatus is soft, white and thick and approaching the stipe the texture gets thicker. Normally, the stem may be lacking but if it presents, it is normally about 0.5 to 4 cm in length, dense, firm, and asymmetrical or

horizontal. The texture is compact, parched and normally hairy or velvety by the base. When the stem are present, the lamellae can be seen as broad and whitish or grayish in color. Whitish to pale-purple or purplish grey spore's prints can be seen on P. ostreatus. The spores are somehow rounded or oval, smooth and having measurement of about 7-9 x 3-4 microns ("Encyclopedia of Life", 2016).

2.1.2 Benefits of *P. ostreatus*

P. ostreatus is loaded with many beneficial nutrients. They are not only free of cholesterol, free of fats, free of gluten, fairly low in calories and very low in sodium, they are also packed with high level of fibre, iron, protein and it contain substantial amount of selenium, zinc, folic acid, potassium, phosphorus, calcium as well as B1, B3, B5, B12, C and D vitamins (Sayner, 2014). Current research shows that *P. ostreatus* contains anti-cancer, anti-oxidant and cholesterol lowering properties (Sayner, 2014). A statement released by Paul Stamets who is an expert in mushroom mentioned that oyster mushroom stand out as excellent cronies in enlightening human and ecological wellbeing compared to other commonly consumed mushrooms. Oyster mushroom enjoys a tremendous reputation as it is the easiest to be cultivated, highly beneficial and therapeutically reassuring (Sayner, 2014)

2.1.2.1 Medicinal Use of *P.ostreatus*

P. ostreatus contains numerous possible therapeutic usage. It is said to be effective in preventing constipation, hangovers, high blood pressure and it could help in the recovery from exhaustion (Adjapong et al., 2015). Isomers called lovastatin are produced naturally by *P. ostreatus* and this isomer is a renowned blood cholesterol reducing compounds ("Encyclopedia of Life", 2016). Besides, Ubiquitin protein which have antiviral or sometimes even anti-HIV properties has been found in *P. ostreatus.* A research conducted on

rats showed that *P. ostreatus* rich diets could hinder the growth of tumor and prevent from substances which initiate colon cancer ("Encyclopedia of Life", 2016).

2.1.2.2 Mycoremediation of *P.ostreatus*

P. ostreatus has validated its capability to break down the essential molecular constituents of oil, creosote, herbicides, pesticides, waste from weaponries manufactures as well as other manufacturing toxin such as wastewater of oil refinery. Moreover, it has been proven to both forbearing to high level of heavy metals and they are capable to remove and deliberate these from their substrate ("Encyclopedia of Life", 2016). A previous studies conducted discovers the adsorption potential of *P. ostreatus* to eliminate copper, nickel, zinc and chromium from water (Javaid, Bajwa, Shafique, & Anwar, 2011).

2.2 Fungal Growth Media

There are various media or substrate use to cultivate mushroom producing fungi ranging from nutrient media to wild log. For the cultivation of fungi, Potato Dextrose Agar (PDA) is normally used (Aryal, 2015). The crucial aspect which determines the cost-effectiveness of mushroom cultivation is the use of proper substrate (Rajapakse et al., 2010).

2.2.1 Potato Dextrose Agar (PDA)

PDA is a common growth medium for fungi and molds (Aryal, 2015). PDA is used to detect molds or yeasts in prepared foods and dairy products (Aryal, 2015). Besides, PDA is also used for the cultivation of molds and yeasts from medical samples. PDA infused with tartaric