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ANALYSIS OF FORMULATION MEDIA FOR PLANTING OYSTER MUSHROOM (Pleurotus ostreatus)AGRICULTURAL WASTE BASED MATERIALS

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Abstract

The effort of Indonesian people to fulfill their protein intake in an economically accessible way is by producing and consuming oyster mushrooms, because their protein content was viable as an alternative to animal-based products. Combination of sugarcane bagasse, palm fronds (PKS), and sawdust can be used as growing medium for oyster mushrooms. The aim of this study was: (1) to analyze the change in the pH of the combination media formulation of Palm Oil Frond Waste (PKS), sugarcane bagasse, and sawdust; (2) identifying the composition of nutrients in the aforementioned agricultural waste as a growing medium for oyster mushroom. This study was composed of two steps: 1) Preparing the composition of the growing medium from agricultural waste; and 2) Analyzing nutrient composition of the growing medium of oyster mushroom. The research was conducted by using Analysis of Variance (ANOVA) with a Non-Factorial Completely Randomized Design (RAL). The combination of oyster mushroom growing medium from palm fronds, sugarcane bagasse, and sawdust has different pH levels and nutritional contents. The combination of M0 – M8 oyster mushroom growing medium has the suitable level of pH to grow the mushrooms at 6,5 – 8,0 pH. From the formulation analysis of nutrient in the combination of M0 – M8, it can be used as a reference for the nutrient content of oyster mushrooms growing medium from palm fronds and sugarcane bagasse.

Keywords: Pleurotus ostreatus; Agricultural Waste; Protein; Nutrient

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INTRODUCTION

Protein is a source of energy and a substance that regulates the body. Protein is also useful as an enzyme biocatalyst in chemical processes. One source of plant food known to be high in protein is soybeans which are processed into tempeh and tofu (Ginting et al., 2013; Nasution, 2016). Hence, with the recent increase in soybean prices and scarcity in Indonesia, people require other alternatives.

The alternative being developed by the community is to consume and produce white oyster mushrooms. The nutrition in oyster mushrooms is first rate for human body and for fulfilling family nutrition, including 19-35% protein containing 9 amino acids, 72% unsaturated fat and high fiber content (7.4 - 24.6%) (Nasution et al., 2017; Rosmiah et al., 2020). In terms of protein content, oyster mushrooms can be used selectively as a protein food source that the body needs. In addition, oyster mushrooms have meaty flavor.

The body parts of oyster mushrooms and their mycelia are known to have health benefits due to their secondary metabolite content. The commercially packaged oyster mushroom secondary metabolite is lovastin. Lovastin is a class of terpenoids that have anti-cholesterol activity (Morris et al., 2017). Therefore, it is expected that oyster mushrooms can be used as a source of vegetable protein and non-cholesterol food.

Results from previous research conducted by Mardiana et al., (2014) found that the use of agricultural waste (bagasse) as a medium for white oyster mushroom cultivation can replace 75% of sawdust. Safitri (2011), said that the addition of bagasse into conventional growing media was effectively used as a growth medium for oyster mushroom cultivation. The nutrient content needed by oyster mushrooms is more easily absorbed in bagasse media than sawdust media and affects the growth rate of oyster mushrooms as well as affects the physical quality and nutritional content of the mushrooms.

The planting media for several edible mushrooms, including the oyster mushroom growing media, uses wood sawdust. With the increasing scarcity of sawdust, an alternative to sawdust media is needed, the supply of which is decreasing. The alternative that can be given is the use of agricultural and plantation waste that has not been utilized (Mardiana et al., 2021).

Factors affecting the growth and production of oyster mushrooms include composition, humidity, pH and surfactant content (Nugroho et al., 2019). Hence it is necessary to analyze the suitability of the formulation of alertanative media for the use of agricultural and plantation wastes.

The objective of the study was to analyze the changes in pH of the combination media formulation of palm frond waste (PKS), bagasse powder waste and sawdust, as well as identify the nutrient content of the composition of agricultural waste media (oil palm fronds, bagasse and sawdust) as media of oyster mushroom cultivation. The results of this study are expected to contribute to the formulation of oyster mushroom cultivation media (baglog) using agricultural waste raw materials that can be produced in the future.

RESEARCH METHODS

The materials used in this study were sugarcane baggase, palm frond sifted to 10 mesh size, F2 oyster mushroom seeds, sawdust, lime, corn flour. The tools used consist of 2 kg PP (polypropylene) type plastic, baglog neck rings, autoclaves, Bunsen, masks, knife spoons, cotton, stationery and cameras. The composition of the mushroom media consisted of sugarcane bagasse and palm frond according to the treatment combination, 15% by weight of the material and 1% of dolomite lime (CaCo3) by weight of the material as a source of nutrients and minerals and 0.5% corn flour by weight of the material. The research method used Analysis of Variance (ANOVA) with Completely Randomized Design (CRD) Non Factorial.

The treatment combination consisted of: M0 (100% sawdust); M1 (100% Sugarcane Bagasse); M2 (75% Sugarcane Bagasse + 25% Sawdust); M3 (50% Sugarcane Bagasse + 50% Sawdust); M4 (25% Sugarcane Bagasse + 75% Sawdust); M5 (Palm Palm Powder 100%); M6 (75% PKS + 25% Sawdust); M7 (50% PKS + 50% Sawdust); M8 (25% PKS + 75% Sawdust).

The nutrient content measured in the composition of the media included pH, C, N, P, K, Ca, Mg, Zn, Cu, Mn, Fe, S, lignin and cellulose content. Another parameter measured in this study was the observation of vegetative growth in the form of mycelium growth presentation which was measured every week since 1 week after inoculation.

RESULTS AND DISCUSSION

1. pH Value of Oyster Mushroom Growing Media

Oyster mushrooms can grow on growing media which has a water content of ± 60%, and degree of acidity or pH 6-7 and room humidity (RH) for oyster mushroom cultivation 80 to 90 (Umiyati et al., 2013).If the place where it grows is ultra- dry or the water content is less than 60%, the mushroom mycelium cannot absorb nutrients properly so it grows thin. Conversely, if the water content in the location of growth is extremely high, the mycelium will rot anddead.The pH value in this study is presented in Table 1.

Table 1. The pH Value of the Planting Media Formulation

Treatment	Media pH			
	Day 2	Day 4	Day 6	After Sterilization
M0	7	6,5	7	7
M1	6	6,5	7	7
M2	6,5	6,5	7,5	7,5
M3	6,5	7	6,5	7
M4	6	6,5	6,5	7
M5	5,5	6	6,5	7
M6	5,5	6	7	7
M7	5,5	6	7	7
M8	6	6,5	7	7

Note: M0, M1, M2, M3, M4, M5, M6, M7, AND M8 treatment notation for oyster mushroom growing media composition.

Table 1 indicates that the formulation of media had a lot of changes from the initial composition, namely the media with a combination of palm fronds which on the first two days was 5.5 while the media with the addition of bagasse did not meet much decrease. Table 1 also indicates an increase in pH in all growing media, and shows pH stability on day 7 and after the sterilization process.

Sumarsih (2010) states that the changes in the pH of growing medium occurred due to the decomposition of lignocellulose and other organic compounds into organic acids. After the sterilization process, the pH value is generally all neutral, namely 7-7.5. Optimal substrate acidity for the growth of oyster mushroom mycelium in acidic conditions with a pH of 5.5 – 6.5 (Setiagama & Suryani, 2014). Based on Seswati (2013), the level of acidity of the media is very influential on the growth of oyster mushrooms. If the pH is extremely low or extremely high, the growth of the fungus will be inhibited. The acidity of the media needs to be adjusted between pH 6-7 using lime (calcium carbonate). Based

on Seswati (2013), media with highly acidic pH makes mycelium growth slow and not optimal. Research by Kusumaningrum et al., (2017) white oyster mushrooms can grow at pH 6-8 with the fastest growth at pH 8.

2. Nutrient Content of Oyster Mushroom Growing Media

Good mushroom mycelium growth is supported by good composition. The agricultural waste used in the formulation of the oyster mushroom growing media is waste of palm oil fronds and bagasse. The media has good nutrition for mycelium growth and oyster mushroom production.

The elements analyzed were carbon (C), Total Nitrogen, Phosphorus (P2O5), Potassium (K2O), Magnesium (Mg), Sulfur (S), Manganese(Mn), Copper (Cu), Calcium (Ca), Iron (Fe) and Zinc (Zn) in basic media before giving organic nutrients are presented in Table 2.

Table 2. Results of Analysis of Nutrient Content of Oyster Mushroom Growing Media

Parameter	Treatment									Information
	M0	M1	M2	M3	M4	M5	M6	M7	M8	
C (%)	21.5	19.3	23	22.7	25.4	17.6	22.2	22.9	21.7	Calculation
N-Total (%)	0.45	0.42	0.41	0.39	0.39	0.38	0.39	0.43	0.39	Titrimetry
P2O5 (%)	0.3	0.7	0.63	0.5	0.46	0.92	1.05	0.71	0.32	Spectrophotometer
K2O (%)	0.53	0.99	0.69	0.6	0.63	0.34	0.44	0.43	0.2	AAS
Mg (mg/kg)	476	597	675	735	890	408	391	425	412	AAS
S (%)	0.73	1.05	1.2	0.13	0.62	0.64	0.02	1.24	1.23	Gravimetry
Mn (mg/kg)	14.3	45.9	41.4	32.2	24.6	18.8	21.1	18.4	12.1	AAS
Cu (mg/kg)	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.46	0.56	<0.006	AAS
Ca (%)	0.16	0.14	0.15	0.16	0.16	0.14	0.11	0.12	0.13	AAS
Fe (mg/kg)	51.9	122	124	120	60.4	304	282	405	63.6	AAS
Zn (mg/kg)	3.4	3.32	3	2.58	3.13	3.1	3.08	8.57	0.93	AAS

The results of the analysis of nutrient content presented in Table 2 indicate that all compositions of planting media based on agricultural waste have different nutrient content. It is appropriate with the amount of nutrients added and contained in the composition of the planting medium. The nutrients analyzed in Table 2 are the basic needs of plant growth. The nutrient analysis of the Oyster Mushroom media in Table 2 can be a reference for the elements of good Oyster mushroom planting medium. Based on Puspaningrum (2013), molasses contains components of the mineral elements K, Ca, Cl, and sugar which is composed of sucrose and glucose, while the tofu pulp itself contains substances including carbohydrates.

One of the metabolic elements that greatly affect the growth of mycelium is nitrogen. Based on Puspaningrum (2013) nitrogen works to stimulate and

accelerate the growth of mycelium. Based on Suparti & Marfuah (2015). In addition, nitrogen is to accelerate the mycelium and also help to form the cap, Phosphorus is to form the vegetative parts such as the hood and stalks and Potassium also works in the formation of fruiting bodies, as an activator. Pospor is to in this case P_2O_5 is a constituent of several enzymes, proteins (ATP, RNA and DNA), it also improves plant absorption of nutrients for the better. The element Potassium acts as a regulator of plant physiological processes such as photosynthesis, accumulation, translocation, transportation of carbohydrates, regulates the distribution of water in tissues and cells. The element Magnesium is an activator that acts as an energy transport for several enzymes in plants. Calcium plays a role in cell growth, strengthening and maintaining cell walls. Sulfur is needed for the formation of amino acids, as an activator, co-factor or enzyme regulator and plays a role in plant physiology (Mukhlis, 2017). To stimulate the growth of the oyster mushroom fruit bodies, nutrients that contain elements C, N, P and K are needed (Mardiana et al., 2021).

The initial formation of the mycelium is greatly influenced by the nutrient content of the substrate and the nutrients added to the oyster mushroom baglog. Suharnowo et al., (2012) states that the nutrients present in the medium act as stimulants for the formation of mycelium. It can be seen that the nutritional content contained in the fronds of oil palm is 6.06% crude protein, 1.00% crude fat, and 18.30% hemicellulose. Febrina et al., (2015) and Arpinaini et al., (2017) states that oil palm fronds contain 20.7% lignin, and 43-44.5% α-cellulose. Sawdust itself has a content such as cellulose which is 33-38%, hemicellulose 15-25%, and lignin 18-33%.

Rosmiah et al., (2020) adds that to meet the requirements for oyster mushroom growth include moisture content, substrate acidity (pH), nutrition, humidity and air temperature. The Ca content in oyster mushroom cultivation media also serves as a source of nutrition for mushroom growth which affects the wet weight of the mushrooms.

CONCLUSION

The combination of oyster mushroom growing media from waste palm fronds, bagasse and sawdust has different pH and nutrient content. The combination of growing media for Oyster Mushrooms M0-M8 has a pH that suits the needs of Oyster Mushroom growing media, namely 6.5-8.0. From the results of the analysis of the formulation of nutrient content in the M0-

M8 treatment combination, it can be used as a reference for the nutrient content of oyster mushroom media, palm fronds of oil palm and sugarcane bagasse.

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