



## Study on Maturity Level of *Pleurotus Cystidiosus*-2 Maple Oyster Mushroom Emphasized on Organoleptic Taste and Nutrient Content

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### Abstract

Mushroom is most diverse organisms on earth and since primitive times have played a vital role in human welfare. The fresh mushroom contains about 85-90% moisture, 3% protein, 4% carbohydrates, 0.3-0.4% fats and 1% minerals and vitamins as well as some medicinal properties like lowering blood cholesterol level, defense against cancer and invigorating hair growth. Mushroom is an organic vegetable and the production of mushroom is an eco-friendly and profitable agribusiness but labour intensive. It does not require any cultivable land and can be grown in room by racking vertically. Mushroom cultivation can help reduce vulnerability to poverty and strengthens livelihoods through the generation of a fast yielding and nutritious source of food and a reliable source of income. Mushrooms are being grown on commercial scale in many parts of the world, China produces 64 % of all edible mushrooms in the world and 85% of all oyster mushrooms all over the world (*Pleurotus spp.*) is also produced in China. These mushrooms have the ability to colonize and degrade a wide variety of ligno cellululosic wastes with relatively short cycle. Many studies have been conducted to test the ability of *Pleurotus* to grow on different agro wastes, such as cassava peels, cotton seed hulls, coffee husks, wheat straw, barely straw, saw dust and sinar straw tomato fruit pulp and peel, coffee pulp, sugarcane residues. These by-products are left to rot in the field or are disposed of through burning. These residues associated with mycelium also have a great potential for use as fodder animal and as fertilizer in agriculture.

**Keywords:** Mushroom; Hypogenous; Environmental; Organoleptic; Nutrient content

### Introduction

Mushroom is one of the most diverse organisms on earth and since primitive times have played a vital role in human welfare [1]. A mushroom is the fleshy and spore-bearing fruiting body of a fungus and belongs to the class Basidiomycetes under the order Agaricales in fungal classification, typically produced above the ground on soil or on its food substrate. It has been universally used as a food and medicine by different civilizations since ancient time due to its delicious taste, flavor, dietetic qualities and several medicinal properties [2, 3]. The fresh mushroom contains about 85-90% moisture, 3% protein, 4% carbohydrates, 0.3-0.4% fats and 1% minerals and vitamins as well as some medicinal properties like lowering blood cholesterol level, defense against cancer and invigorating hair growth [4]. Edible mushrooms are also rich in vitamins such as niacin, riboflavin, vitamin D, C, and B complex [5]. FAO recommended edible mushrooms as a food to meet protein requirement of developing countries where a large number of populations depends mainly on cereal crops [6]. Mushroom is an organic vegetable and the production of mushroom is an eco-friendly and profitable agribusiness but labour intensive [7]. It does not require any cultivable land and can be grown in room by racking vertically. Mushroom cultivation can help reduce vulnerability to poverty and strengthens livelihoods through the generation of a fast yielding and nutritious source of food and a reliable source of income [8]. Mushrooms are being grown on commercial scale in many parts of the world. The commercial cultivation first started in Europe with the beginning of last century but the history of mushroom production is very recent in Bangladesh. Wildly, 20 species of mushroom are grown in the country, of which 5-6 are poisonous; and the recommended

species for cultivation are oyster (*Pleurotus spp.*) and white button.

Human relationships with mushrooms are ancient and fascinating. Mushrooms are macro fungi with distinctive basidiomata or ascomata which can be either hypogenous or epigenous, large enough to be seen with naked eye. The number of different kind of mushroom in the world is estimated to be around 140,000. *Pleurotus sp.*, commonly known as oyster mushrooms, are edible fungi cultivated worldwide especially in South East Asia, India, Europe and Africa [8]. China produces 64% of all edible mushrooms in the world and 85% of all oyster mushrooms all over the world (*Pleurotus spp.*) is also produced in China [9]. Oyster mushrooms is the third largest [10] commercially produced mushroom in the world; however, Sánchez [11] reported that *P. ostreatus* is the second largest next to *Agaricus bisporus* in the world market. It consists of a number of different species including *Pleurotus ostreatus*, *P. sajor-caju*, *P. cystidiosus*, *P. cornucopiae*, *P. pulmonarius*, *P. tuberregium*, *P. sapidus*, *P. citrinopileatus* and *P. flabellatus*, which have been cultivated in temperate and subtropical regions of the world. Oysters are naturally found on rotten wood material. The growing and

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consumption interest of oyster mushroom is increasing largely due to its taste, medicinal and nutritional properties [12]. *P. ostreatus* demands few environmental controls, and their fruiting bodies are not often attacked by diseases and pests, and they can be cultivated in a simple and cheap way. All this makes *P. ostreatus* cultivation an excellent alternative for production of mushrooms when compared to other mushrooms. Therefore, it is better for unskilled farmers than other mushrooms. Mushroom cultivation provides an alternative employment and it contributes to food security to rural disadvantaged groups [13]. These mushrooms have the ability to colonize and degrade a wide variety of lingo cellulosic wastes with relatively short cycle [14]. Agro-industrial waste is produced in huge amounts, and it becomes an interesting substrate, due its commercial exploitation as well as associated environmental problems. Many studies have been conducted to test the ability of Pleurotus to grow on different agro wastes, such as cassava peels, cotton seed hulls, coffee husks, wheat straw, barely straw, saw dust and sinar straw tomato tuff fruit pulp and peel, coffee pulp, sugarcane residues . These by-products are left to rot in the field or are disposed of through burning. These residues associated with mycelium also have a great potential for use as fodder animal and as fertilizer in agriculture [15-21]. The objective of this study was to study on the maturity level of *Pleurotus cystidiosus-2* maple oyster mushroom emphasized on organoleptic taste and nutrient content

## Materials and methods

### Location of experiment

*Pleurotus cystidiosus-2* was collected from Mushroom Development Institute, Savar, Dhaka, Bangladesh from June to December 2019.

### Extraction Procedure

Fruiting body of *Pleurotus cystidiosus-2* dried first and then powered. The powered sample was then kept in 95% ethanol in different conical flask. 5% extraction of mushroom was done here (5gm mushroom in 100 ml ethanol). The conical flask of mushroom was kept in shaker for two days in 40 c. After that the solution was filtered by clothes to take solvent portion and then again the solvent

portion was filtered through Whatman filter paper. After that the solvent is evaporated through rotary evaporator and the solid portion was collected. From 500gm *Pleurotus cystidiosus-2* mushroom 37gm extract was collected.

### Quantitative Estimation

**Determination of total protein:** Total protein content was measured according to the Biuret method **Determination of total lipid:** Total lipid was determined by slight modified method of Folch *et al.* (1957).

**Determination of crude fiber:** Crude fiber was determined by gravimetric method.

**Determination of total ash:** Ash was determined by following the standard Association of Official Agricultural Chemists (AOAC) method.

**Determination of total carbohydrate:** The content of the available carbohydrate was determined by the following equation: Carbohydrate (g/100g sample) = [100 - (Moisture + Fat + Protein + Ash + Crude Fiber)]

## Results and Discussion

### Organoleptic Taste or Sensory Evaluation

For sensory evaluation, we had made a board of 10 people and they had expressed their opinion. In Table 1, Score of Sensory Evaluation for Pre-mature PCYS-2 Mushroom Fries, the highest over al Appearance was good, the highest Colour was good, maximum Crispiness was less crispy, maximum Flavour was good, the highest Taste was fair and the highest Acceptability was acceptable (Table 2).

For sensory evaluation, we had made a board of 10 people and they had expressed their opinion. In Table 2, Score of Sensory Evaluation for Mature PCYS-2 Mushroom Fries, the highest Overall Appearance was Excellent, the highest Colour was good, maximum Crispiness was less crispy, maximum Flavour was good, the highest Taste was good and the highest Acceptability was acceptable. (Table 3)

Overall Appearance	Colour	Crispiness	Flavour	Taste	Acceptability
4=Excellent	4=Excellent	5=Crispy	4=Excellent	4=Excellent	4=Highly Acceptable
3=Good	3=Good	4=Moderate Crispy	3=Good	3=Good	3=Acceptable
2=Fair	2=Fair	3=Less Crispy	2=Slightly Odorous	2=Fair	2=Less Acceptable
1=Poor	1=Poor	2=Leathery	1=Bad odour	1=Poor	1=Not Acceptable
		1=Not Crispy			

Table 1: Score of Sensory Evaluation for Pre-mature PCYS-2 Mushroom Fries.

Overall Appearance	Colour	Crispiness	Flavour	Taste	Acceptability
4=Excellent	4=Excellent	5=Crispy	4=Excellent	4=Excellent	4=Highly Acceptable
3=Good	3=Good	4=Moderate Crispy	3=Good	3=Good	3=Acceptable
2=Fair	2=Fair	3=Less Crispy	2=Slightly Odorous	2=Fair	2=Less Acceptable
1=Poor	1=Poor	2=Leathery	1=Bad odour	1=Poor	1=Not Acceptable
		1=Not Crispy			

Table 2: Score of Sensory Evaluation for Mature PCYS-2 Mushroom Fries.

Overall Appearance	Colour	Crispiness	Flavour	Taste	Acceptability
4=Excellent	4=Excellent	5=Crispy	4=Excellent	4=Excellent	4=Highly Acceptable
3=Good	3=Good	4=Moderate Crispy	3=Good	3=Good	3=Acceptable
2=Fair	2=Fair	3=Less Crispy	2=Slightly Odorous	2=Fair	2=Less Acceptable
1=Poor	1=Poor	2=Leathery	1=Bad odour	1=Poor	1=Not Acceptable

Table 3: Score of Sensory Evaluation for Over Mature PCYS-2 Mushroom Fries.

For sensory evaluation, we had made a board of 10 people and they had expressed their opinion. In Table 3, Score of Sensory Evaluation for over mature PCYS-2 Mushroom Fries, the highest overall Appearance was excellent, the highest Colour was good, maximum Crispiness was crispy, maximum Flavour was good, the highest Taste was fair and The highest Acceptability was acceptable (Table 4).

For sensory evaluation, we had made a board of 10 people and they had expressed their opinion. In Table4, Score of Sensory Evaluation for Pre- mature PCYS-2 Mushroom Soup, the highest Overall Appearance was excellent, the highest Colour was good, maximum Crispiness was moderate crispy, maximum Flavour was good, the highest Taste was good and The highest Acceptability was highly acceptable (Table 5).

For sensory evaluation, we had made a board of 10 people and they had expressed their opinion. In Table5, Score of Sensory Evaluation for Mature PCYS-2 Mushroom Soup, the highest over al Appearance was good, the highest Colour was good, maximum Crispiness was moderate crispy, maximum Flavour was good, the highest Taste was good and the highest Acceptability was acceptable (Table 6).

For sensory evaluation, we had made a board of 10 people and they had expressed their opinion. In Table 6, Score of Sensory Evaluation for Over Mature PCYS-2 Mushroom Soup, the highest over al Appearance was fair, the highest Colour was good, maximum Crispiness was less crispy, maximum Flavour was good, the highest Taste was good and the highest Acceptability was acceptable.

## Nutritional analysis

### Fiber Content

The Fiber content of different stages of pleurotus cystidiosus-2(PCYS-2) including Pre-mature, Mature and Over mature were found about 39.13gm, 37.24gm and 33.95gm respectively (Table 7 and Figure 1). In Figure 1, The Fiber content of different stages of pleurotus cystidiosus-2(PCYS-2) including Pre-mature, Mature and Over mature were found about 39.13gm, 37.24gm and 33.95gm respectively. The highest fiber content was found in the Pre-mature stage.

### Lipid content

The Lipid content of different stages of pleurotus cystidiosus-2(PCYS-2) including Pre-mature, Mature and Over mature was found about 1.01gm, 2.55gm and 10.05gm respectively (Table 8 and Figure 2).

In figure 2, The Lipid content of different stages of pleurotus cystidiosus-2(PCYS-2) including Pre-mature, Mature and Over mature were found about 1.01gm, 2.55gm and 10.05gm respectively. The highest lipid content was found in the Over mature stage.

### Protein Content

The Protein content of different stages of pleurotus cystidiosus-2(PCYS-2) including Pre-mature, Mature and Over mature were found about 5.30gm, 5.60gm and 4.32gm respectively (Table 9 and Figure 3).

In figure 3, The Protein content of different stages of pleurotus cystidiosus-2(PCYS-2) including Pre-mature, Mature and Over mature were found about 5.30gm, 5.60gm and 4.32gm respectively. The highest protein content was found in the mature stage.

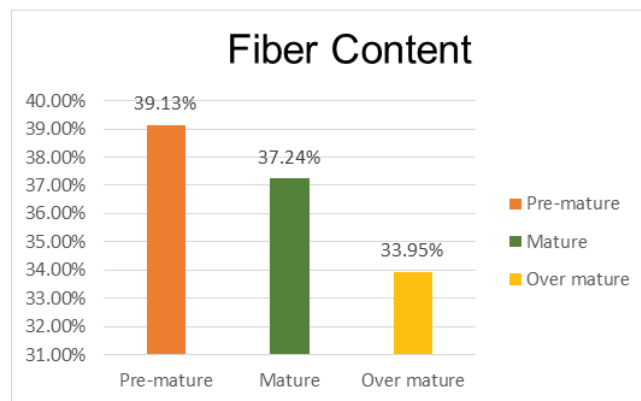


Figure 1: Fiber content of different stages of Pleurotus cystidiosus-2.

Overall Appearance	Colour	Crispiness	Flavour	Taste	Acceptability
✓ 4=Excellent	4=Excellent	5=Crispy	4=Excellent	4=Excellent	✓ 4=Highly Acceptable
3=Good	✓ 3=Good	✓ 4=Moderate Crispy	✓ 3=Good	✓ 3=Good	3=Acceptable
2=Fair	2=Fair	3=Less Crispy	2=Slightly Odorous	2=Fair	2=Less Acceptable
1=Poor	1=Poor	2=Leathery	1=Bad odour	1=Poor	1=Not Acceptable
		1=Not Crispy			

Table 4: Score of Sensory Evaluation for Pre-mature PCYS-2 Mushroom Soup.

Overall Appearance	Colour	Crispiness	Flavour	Taste	Acceptability
4=Excellent	4=Excellent	5=Crispy	4=Excellent	4=Excellent	4=Highly Acceptable
✓ 3=Good	✓ 3=Good	✓ 4=Moderate Crispy	✓ 3=Good	✓ 3=Good	✓ 3=Acceptable
2=Fair	2=Fair	3=Less Crispy	2=Slightly Odorous	2=Fair	2=Less Acceptable
1=Poor	1=Poor	2=Leathery	1=Bad odour	1=Poor	1=Not Acceptable
		1=Not Crispy			

Table 5: Score of Sensory Evaluation for Mature PCYS-2 Mushroom Soup.

Overall Appearance	Colour	Crispiness	Flavour	Taste	Acceptability
4=Excellent	4=Excellent	5=Crispy	4=Excellent	4=Excellent	4=Highly Acceptable
3=Good	✓ 3=Good	4=Moderate Crispy	✓ 3=Good	✓ 3=Good	✓ 3=Acceptable
✓ 2=Fair	2=Fair	✓ 3=Less Crispy	2=Slightly Odorous	2=Fair	2=Less Acceptable
1=Poor	1=Poor	2=Leathery	1=Bad odour	1=Poor	1=Not Acceptable
		1=Not Crispy			

Table 6: Score of Sensory Evaluation for Over Mature PCYS-2 Mushroom Soup.

Pre-mature	39.13%
Mature	37.24%
Over mature	33.95%

Table 7: Score of Sensory Evaluation (1).

Pre-mature	1.01%
Mature	2.55%
Over mature	10.05%

Table 8: Score of Sensory Evaluation (2).

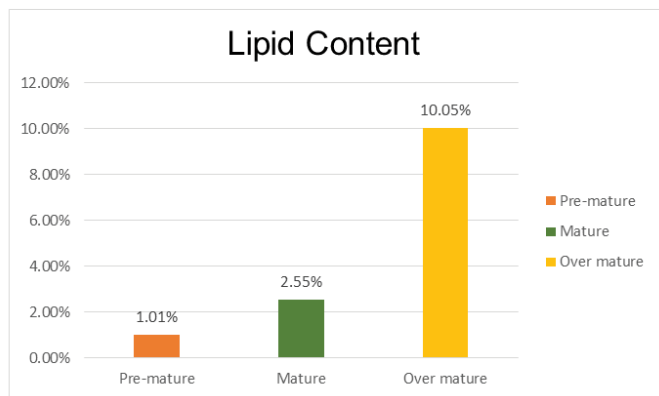


Figure 2: Lipid content of different stages of Pleurotus cystidiosus-2.

Pre-mature	5.30%
Mature	5.60%
Over mature	4.32%

Table 9: Score of Sensory Evaluation (3).

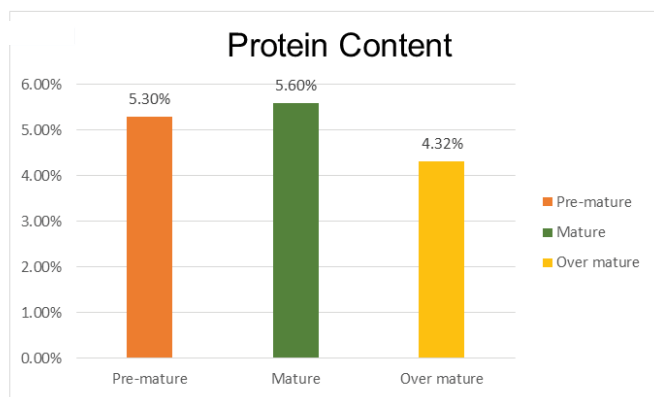


Figure 3: Protein content of different stages of Pleurotus cystidiosus-2.

### Carbohydrate Content

The Carbohydrate content of different stages of pleurotus cystidiosus-2(PCYS-2) including Pre-mature, Mature and Over mature were found about 45.32gm, 43.29gm and 38.43gm respectively (Table 10 and Figure 4).

In figure 4, The Carbohydrate content of different stages of pleurotus cystidiosus-2(PCYS-2) including Pre-mature, Mature and Over mature were found about 45.32gm, 43.29gm and 38.43gm respectively. The highest carbohydrate content was found in the Pre-mature stage.

### Total Ash Content

The Total Ash content of different stages of pleurotus cystidiosus-

2(PCYS-2) including Pre-mature, Mature and Over mature was found about 9.24gm, 11.32gm and 13.25gm respectively (Table 11 and Figure 5).

Pre-mature	45.32%
Mature	43.29%
Over mature	38.43%

Table 10: Score of Sensory Evaluation (4).

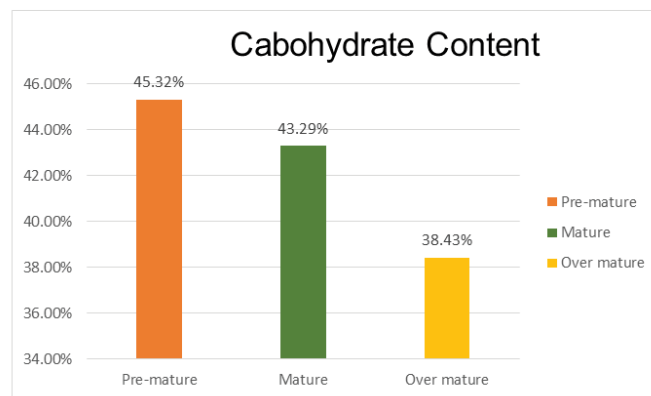


Figure 4: Carbohydrate content of different stages of Pleurotus cystidiosus-2.

Pre-mature	9.24%
Mature	11.32%
Over mature	13.25%

Table 11: Score of Sensory Evaluation (5).

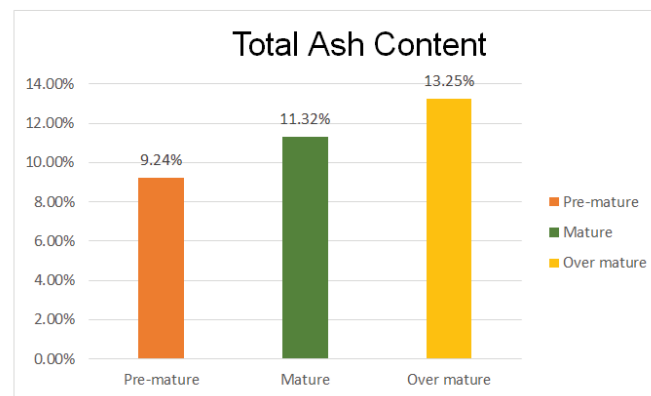


Figure 5: Total Ash content of different stages of Pleurotus cystidiosus-2.

In figure 5, The Total Ash content of different stages of pleurotus cystidiosus-2(PCYS-2) including Pre-mature, Mature and Over mature were found about 9.24gm, 11.32gm and 13.25gm respectively. The highest total ash content was found in the Over mature stage.

Two major points of this study were Sensory Evaluation or organoleptic taste of different stages of Pleurotus cystidiosus-2 and Nutritional analysis of different stages of Pleurotus cystidiosus-2. In the Sensory Evaluation or Organoleptic taste, The Overall Appearance, Colour, Crispiness, Flavour And Taste were varied in the different stages of Pleurotus cystidiosus-2 Mushrooms of Fries and Soups. In the nutritional analysis, The highest fiber content was found in the Pre-mature stage, highest lipid content was found in the Over mature stage, highest protein content was found in the Mature stage, highest carbohydrate content was found in the Pre-mature stage and highest total ash content was found in the Over mature stage. As higher protein



content was in the mature stage, the mature stage are better than other two stage. As we seen through the review, *Pleurotus cystidiosus* is a novel edible mushroom with high nutritional and biomedical importance, since it contains a number of bioactive components develop its large number of therapeutic function. Moreover, due to high nutritional values, these mushrooms may provide significant support against malnutrition disease. Thus the majority of research programs had been focused on extract from the fruiting body and there have been fewer studies on extract from the cultivated fungi. Therefore, further research may be oriented in that direction. Since, most of the therapeutic effects of *P. cystidiosus* are based on in vivo and in vitro studies, clinical trials are needed to fully realize its potentials.

This study represents the Sensory Evaluation or organoleptic taste of different stages of *Pleurotus cystidiosus*-2 and Nutritional analysis of different stages of *Pleurotus cystidiosus*-2. In the organoleptic taste of pre-mature stage, the highest Overall Appearance was good, the highest Colour was good, maximum Crispiness was less crispy, maximum Flavour was good, the highest Taste was fair and The highest Acceptability was acceptable. In the mature stage, the highest Overall Appearance was Excellent, the highest Colour was good, maximum Crispiness was less crispy, maximum Flavour was good, the highest Taste was good and the highest Acceptability was acceptable. In the over mature stage, the highest Overall Appearance was excellent, the highest Colour was good, maximum Crispiness was crispy, maximum Flavour was good, the highest Taste was fair and the highest Acceptability was acceptable. In the nutritional analysis, the highest fiber content was found in the Pre-mature stage, the highest lipid content was found in the Over mature stage, the highest protein content was found in the Mature stage, the highest carbohydrate content was found in the Pre-mature stage and

The highest total ash content was found in the Over mature stage. The survival and multiplication of mushrooms is related to a number of factors, which may act individually or have interactive effects among them. The combination of the best air temperature, moisture, nutrient conditions as well as other variables, provides a synergistic effect optimizing the production of mushrooms, with a consequent loss and cost reduction. This review points out that in order to comprehend the challenges in handling *Pleurotus* genus mushroom requires a fundamental understanding of their physical, chemical, biological and enzymatic properties. As we seen through the review, *Pleurotus cystidiosus* is a novel edible mushroom with high nutritional and biomedical importance, since it contains a number of bioactive components develop its large number of therapeutic function. Moreover, due to high nutritional values, these mushrooms may provide significant support against malnutrition disease. Thus the majority of research programs had been focused on extract from the fruiting body and there have been fewer studies on extract from the cultivated fungi. Therefore, further research may be oriented in that direction. Since, most of the therapeutic effects of *P. cystidiosus* are based on in vivo and in vitro studies, clinical trials are needed to fully realize its potentials.

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