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Bioconversion of Coffee Husk for Oyster Mushroom (Pleurotusflorida) Cultivation

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Abstract: Mushroom is a crop which is cultivated in many countries using different agricultural wastes. At present, coffee production is dramatically increasing in the world. Consequently, coffee husk are also increasing at the same time. In order to minimize this hazardous husk, the current study was initiated to evaluate the suitability of coffee husk for cultivation of commercial oyster mushroom species (Pleurotusflorida) after compositing with different main substrate combinations. Oyster mushroom can be cultivated by using two types of substrates such as coffee waste and paddy straw. It can be used in both physical and chemical sterilization. The physical method of sterilization on the substrate paddy straw yields a product average of 416g(w/v) whereas the substrate coffee waste yields a product average of 360g(w/v). Therefore, better yield of oyster mushroom was obtained after bioconversion of this cost-effective and cheap agro-waste of coffee husk.
Keywords: Pleurotusflorida(spawn)-oyster mushroom, paddy straw, coffee waste.

I. INTRODUCTION

Mushroom cultivation is a potential biotechnological process where waste plant materials or negative value crop residues can be converted into valuable food. Mushroom has been studied for nutritional and medical purposes, and various potential antitumor and immune modulator substances, mainly polysaccharides have been identified (Zhang et al., 2007) for medical purposes. Mushrooms are consumed to prevent cancer and cardiac diseases, to improve blood circulation and to reduce cholesterol. They are used for physical and emotional stress, asteoporosis, gastric ulcers and chronic hepatitis; for the improvement of the quality of life of patients with diabetes and especially for the stimulation of immunity. Edibleoysters mushroom foods cultivated on agricultural residues is limited. Such information is important to facilitate the population of mushroom cultivation, processing, marketing and consumptions. Mushroom cultivation is a profitable agribusiness. Oyster mushroom (*Plerotousflorida*) is an edible mushroom having an excellent taste and flavour. It belongs to the class Basidomycetes. It grows wild in the forest and is cultivated in the temperate and subtropical regions of the world. Fungi lack the most important feature of plants – the ability to use energy from the sun directly through chlorophyll. They lack chlorophyll and cannot synthesize their own food. Thus, fungi depend on other organisms for food, absorbing nutrients from the organic material in which they live. The living body of the fungus is mycelium made out of a tiny web of threads (or filaments) called hyphae. Under specific conditions, sexually compatible hyphae will fuse and start to form spores.

The larger spore producing structures (bigger than about 1 mm) are called mushrooms. Mushrooms depend on dead organic matter as saprophytes, on living plants as parasites or they co-exist with other living organisms as symbionts. They grow on grassy ground, rotten wood, leaf litter, dung, cellars and mines. 'Mushroom' is the fleshy spore-bearing organ or fruiting body. Usually, the fruiting bodies are umbrella shaped structures, which produce spores in large numbers. These spores are minute, microscopic and are dispersed through wind. When they happen to fall on suitable substrates (like dead wood, straw, manure, litter or any other cellulose material), the spores germinate and develop into mycelia. As long as the condition is favourable for mycelial development and growth, the mycelia continue to grow, ramify and absorb food from the substrate until they develop many fruiting bodies.

A. Sterilization

Sterilization is the process which is involved in killing of micro-organisms. Millet grains were thoroughly washed and soaked for 24 hours in water, and then sieved. After overnight soaking, 10 kg of grain is taken in a vessel with 15 L ofwater. It is boiled for about 15 minutes and allowed tocool for 15 minutes, water is drained and the spawn isdried in cotton cloth. 120g of gypsum (CaSO4.2H2O) isadded with 30g of ground limestone (CaCO3) and mixedwell. The grain is packed into the polypropylene bags.One bag contains 300-350g of the prepared grain and ispacked tightly. The packed bags are then autoclavedat 121°C.Sterilization requires a minimum of 121°C steam at 15Psi (1 atm pressure) for 15-20 minutes.

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B. Preparation of Spawn Bags

Milo (grain sorghum) is commonly used for making spawn as it shows very good mycelium growth. Millet grains were thoroughly washed and soaked for 24 hours in water, and then sieved. After overnight soaking, 10 kg of grain is taken in a vessel with 15 L of water. It is boiled for about 15 minutes and allowed to cool for 15 minutes, water is drained and the spawn is dried in cotton cloth. 120g of gypsum (CaSO4.2H2O) is added with 30g of ground limestone (CaCO3) and mixed well. The grain is packed into the polypropylene bags. One bag contains 300-350g of the prepared grain and is packed tightly. The packed bags are then autoclaved at 121°C.

C. Inoculum of the Mycelium

The fully grown mycelium plates and the prepared spawn bags are taken into the laminar airflow chamber. After autoclaving the sterilized bags, they are allowed to cool for 24 hours. The bags were immediatelyinoculated with mycelial culture of *P.florida*. The sealed spawn bags are opened and meanwhile the mycelium plate is also opened. The mycelia plates are cut into pieces in a criss-cross manner with the help of the sterile scalpel and forceps. The pieces are then carefully taken out of the plate with forceps. The culture of mycelium is inoculated into the prepared spawn bags in front of the flame (aseptically) in order to prevent contamination. Once inoculated, the spawn bags should be incubated for mycelium of *pleurotus* at 27±2° C for 10-15 days until the mycelium fully cover the grains [8]. After about one week, they should all be shaken to spread the mycelium evenly through the bags. Shaking will speed growth and make the spawn a more even product.

1) Substrate Preparation

a) Paddy straw was collected from NAMBIYUR. The paddy straw was soak in Substrate.

2) Summary: The Distilled water for overnight. Then paddy straw was autoclaved at 121□c for 15 minutes. Aftersterile paddy straw was packed with polythene bag.

a) Filtered Coffee waste was collected from CAFÉ COFFE DAY at HICAS. TheFiltered Coffee Powder was double sterilized. Then packed with polythene bag

b) Paddy straw and Filtered Coffee waste was packed with layer by layer in polythenebag.

3) Collection of Spawn: The Spawn *Pleurotusflorida* was collected from Tamil Nadu AgricultureUniversity (TNAU).

4) Inoculation, Incubation, And Culture Conditions: Three spawn were used for inoculation. Inoculated bags were then placed inside a cold room at 20–25 °C under 80–95% relative humidity with complete darkness during the first three weeks until the substrate was completely colonized with mycelium. Bags were punctured (+shape) using sterile knife from four sides to facilitate primordial initiation.

5) Harvesting

Mushrooms were harvested from the substrate after incubation. The cluster of mushroom were

Harvesting/Day	Bag 1 (in grams)	Bag 2(in grams)	Bag 3(in grams)
21st day	80.4	70.3	0
24th day	87.9	74.3	0
27th day	93.7	83.9	17.9
30th day	71.8	62.5	12.4
TOTAL =	333.8	291.0	30.3

Weighted and several parameters were evaluated. They are harvesting by sterile Knife. The percentage yield of fresh mushroom over the dry weight of the substrate.

After inoculated spawn was produce Mycelium and the Mushroom was matured from substrates. But they growth will be differ in each bags.Finally the cultivated Mushroom was harvested by plucking method. After harvested mushroom was measured with the help of weighing machine.

II. HARVESTING MUSHROOM

1) BAG I - Only Paddy straw substrate.

2) BAG II - Paddy straw with Filtered Coffee Waste substrate.

3) BAG III – Only Filtered Coffee waste

The agricultural paddy straw waste plays an important role in Mushroom Cultivation.

Paddy straw containing high amount of nutrients that helps to grow Mushroom. The cup of coffee truly wonderful thing, but the problem is 99 % of the biomass of the Filtered Coffee waste. However, the Filtered coffee waste still remain the nutrients which

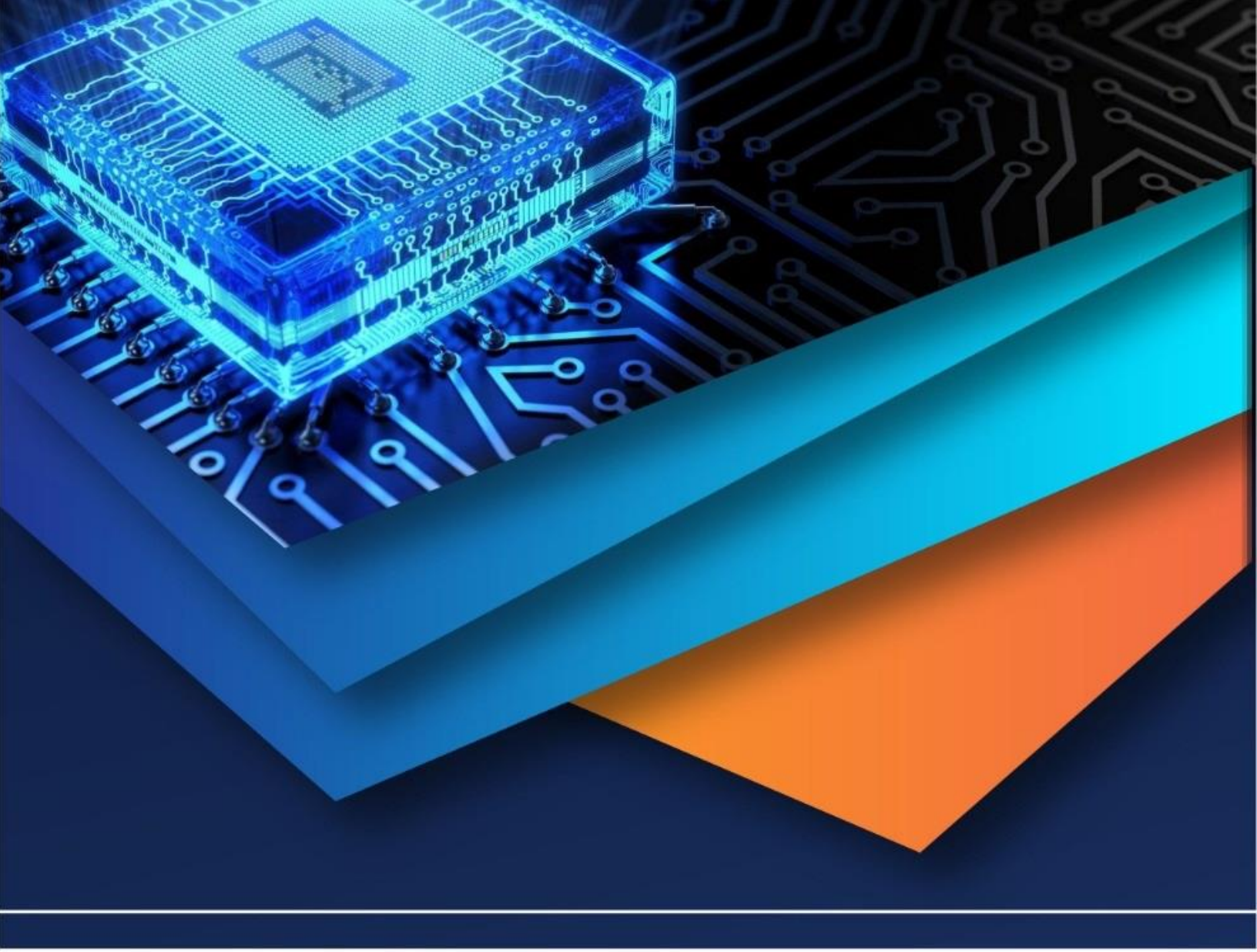
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Oyster mushroom love to grow on. The cheap substrate (Paddy straw & coffee waste) collected from various area and its sterilized and packed in polythene bag. After, that inoculate the spawn into the bag in layer by layer. The incubation time (22-25□c) for 2 – 3 weeks. After incubation the mycelium spread inthe bag and start they growth of mushroom (Oyster Mushroom). After incubation, the Mushroom was harvested, the harvested mushroom there is a high yield in paddy straw bag and much less than amount of growth in Filtered coffee waste compare to the paddy straw bag. Because the paddy straw containing huge amount of nutrition compared to Filtered coffee waste. So, the growth will differ. But fully coffee waste bag takes more time to growth of mushroom. So, the yield will be very low amount of growth.

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