# Oyster Mushroom and its value added products

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# Abstract

Cultivation of mushroom is biotechnological process.Two oyster mushroom studied for its consumption and value added products.*Pleurotus sajor caju* is good in taste and favorite among people as a food.Soup powder made from *Pleurotus sajor caju* and other ingredients has good flavor and taste.Tomato-mushroom ketchup made from *Pleurotus ostreatus* and other ingredients has good aroma and taste.Dried oyster mushrooms can be stored for longer period and used in preparation of curries.Oyster mushroom are rich source of proteins, vitamins and minerals.Oyster mushroom cultivation has short duration than other mushroom which makes its good alternative as a food.


# 1 Introduction

Cultivation of edible mushrooms is a biotechnological process for lingo-cellulosic organic waste conversion. It might be the only current process that combines the production of protein-rich food with the reduction of environmental pollution (Beetz and Kustudia 2004). The production of mushrooms is regarded as the second most important commercial microbial technology next to yeast (Pathak et al. 2009).

The nutritional and medicinal values of mushrooms have long been recognized.Mushrooms are rich source of proteins, vitamins and minerals. Mushroom is considered to be a complete and safest food, suitable for all age groups.The oyster mushroom got its name from its strikingly similar resemblance to a fresh schucked oyster Beltran-Garcia, (1997).

.This nutrient dense versatile food can be taken as a substitute of meat, fish, fruits, and vegetables (Kakon, Choudhury, & Saha, 2012).Recently, however, mushrooms have assumed greater place in the diets due to nutritional values. For example, they are being marketed along major highways and urban centers where the trade now booms. According to the Food and Agriculture Organization (FAO) of the United Nations statistics China is the world’s leading mushroom producer, while the United States and Italy are second and third (Yaoqi Zhang et al 2014)

Edible mushrooms mostly oyster mushrooms is favorite among farmers because of the taste, morphology, growth habit, texture, and habitat. In addition to the above, the natives have observed saprophytic nature of many fungi and have named each fungus after the wood on which it grows. In India, there has been greater interest in mushrooms not only because of protein rich health vegetable (food) but also due to presence of medicinal active compounds. This new class of compounds, termed mushroom nutriceuticals represent an important component of the expanding mushroom biotechnology industry. Fungi are the source of anti-biotics old (penicillin) and new (cephalosporins), the cholesterol-lowering drug lovastatin, and cyclosporins for supporting patients after organ transplants (Watkinson, Boddy, Money 2015).Vitamin D was estimated by HPLC method (Kaushik, Sachdeva, Arora, & Wadhwa, 2014).Vitamin C was determined by Indophenol method as per the procedure as outlined by Food Analysis Laboratory Manual (Zvaigzne, Karklina, Seglina, & Krasnova, 2009).Cultivation of pleurotus,

shitake, milky and paddy mushroom are favorite among growers. This mushroom has been widly used in traditional medicine and reported to posseses various biological activities, including anti microorganisms, antitumor, antioxidant, anti-hypertension, antidiabetic, and anti-inflammation. It has been shown that constant intake of either mushrooms people fitter and healthier. In addition to this mushroom cultivation convert agricultural and forest wastes into useful matter and reduce pollution in the environment. Therefore, mushroom cultivation gives nutritive food reduction of environmental pollution with extra income to farmers. Mushrooms are among the largest fungi, which have attracted the attention of naturalists before microscopes, or even simple lenses had thought of. Mushroom farming is believed to have started in 600 A.D. (http://www.mychampi.com/en/mushrooms/history 2018) in Asia.

# 2 Materials And Methods

Oyster mushroom spawn (*Pleurotus sajor-caju*) was obtained from College of Agriculture pune. *Pleurotus ostreatus* spawn was obtained online.

Following materials were used in the experiment

1. Metal drum to pasteurize the substrate 2. Heater 3. Substrates (sorghum stalk, wheat straw or maize stover) 4. Devices for chopping the substrate 5. Water 6. Bricks or stones to submerge the substrate 7. 2 x Plastic sheets (at least 1.5 m x 1.5 m) 8. Wheel barrow (optional) 9. Garden fork 10.Jik bleach/ disinfectant 11. 6 inch nails 12.Plastic bag in which to pack the substrate 13.Mushroom spawn 14. Racks 15.Scissors 16.Two buckets 17.Mushroom house / structure 18.Nozzle sprayer 19. Muslin cloth 20. Broom

Substrate used is mixture of Maize stalk and sorghum stalk,saw dust and paddy straw were soaked in water with bavastin, bleaching powder and 5% formalin overnight. Substrate were kept for sun dry to remove excess water.6X4 polythene bags filled with substrate.

### 2.1 Preparation and formulation of Potato– mushroom–Tomato soup powder

Soups are commonly used as appetizers. Experiments were conducted to prepare good quality ready-to-make mushroom soup powder using quality mushroom powder produced from the sun dried oyster mushroom. Whole oyster mushrooms were finely ground in mixer grinder. Mushroom soup powder is prepared by mixing this powder with tomato-potato powder and other ingredients (Fig C and D).10-15 grams of powder mixed with water to make one bowl soup with characteristic aroma and taste.The oyster mushroom soup powder can also be used in curry preparation. The moisture content of the newly developed soup was lower than the reports of other studies (Chaudhary, 2015)

**2.2 Cooking procedures of soup powders** Twenty-five gram of the newly developed soup powder was added into 350 ml water and boiled for 5–6 min, and readied for serving of two persons. Dried mushroom (Fig F) can be stored for upto one year and can be used in preparation of curries.

**2.3 Mushroom Ketch-Up** Ketch-up is made by concentrating the pulp of the fruits/ vegetables without seeds.It should be highly viscous in nature.They also contain more of sugar and less of acid. Freshly harvested oyster mushrooms and tomatoes are washed, sliced and cooked in 50% of water for 20 minutes. Mushroom paste is prepared using a mixer grinder.Corn flour and other ingredients are mixed in the paste and cooked to bring it viscous.Then the ketch-up is filled in the sterilized bottles or jars (Fig.E)

# 3 Results

Growth stages in number of days

### 3.1 *Pleurotus sajor caju*

| Substrates | Spawn running | Pinhead formation | Fruiting body formation |
|---|---|---|---|
| **Paddy straw** | 17-20 | 21-23 | 25-27 |
| **Mixture of Maize & sorghum stalk** | 20-23 | 24-27 | 27-30 |
| **Saw dust** | 20-25 | 27-28 | 30-32 |

### 3.2 *Pleurotus ostreatus*

| Substrates | Spawn running | Pinhead formation | Fruiting body formation |
|---|---|---|---|
| **Paddy straw** | 17-20 | 21-23 | 25-27 |
| **Mixture of Maize & sorghum stalk** | 21-22 | 23-25 | 25-28 |
| **Saw dust** | 20-24 | 23-25 | 27-29 |

**Poor spawn run and fruit body formation on saw dust as substrate*

### 3.3 Growth conditions for oyster mushroom and equipments

| Parameter | Low cost | High-tech | High-tech Dual system |
|---|---|---|---|
| Humidity | -bags -spraying walls and floor -evaporative mats, Cloth etc -water spray | -Humidistat -fogging equipment+humidistat -duct system | -Dual system of humidistat |
| Temperature | ambient conditions -evaporative cooling of water | -air conditioner -Thermal exhaust fan system with thermostat -duct system with heating coils+ thermostat | Air at a desired temperature according to the humidity and temperature prevailing in the |
| Light | -natural daylight | Light of 1000-1500lux | |
| Measuring equipment | human body temperature sensors(crude method)<br><br>-Sensing of moisture in the air (again another crude method) | thermometer -wet and dry bulb hygrometer -Digital thermometer -Digital hygrometer | Mushroom growing structure and its' volume |

# 4 Discussion

*Pleurotus spp*. mushroom can degrade and grow on any kind of agricultural or forest wastes, which contain lignin, cellulose and hemicellulose. Poppe (2000) reported that there are about 200 kinds of waste in which edible mushrooms can be produced. White button,crimini, and portabella varieties, is especially common in todays culinary repertoire. The next most common commercial species are shiitake (*Lentinus edodes*), straw (*Volvariella volvacea*), oyster (*Pleurotus ostreatus*), and enoki (*Flammulina ostreatus*). Mycelium growth of *Pleurotus* depends on several factors such as growing media, different media concentration, pH, temperature, nutrient element and some environmental factors. Among all the cultivated mushrooms *Pleurotus* has maximum number of commercially cultivated species suitable for round the year cultivation. Moreover, variation in texture, shape, colour, and aroma are also available.

Quality of soup processed with added Moringa leaf powder has implication on texture and microbiological (Sengev *et al*., 2013).Oyster mushroom is healthy food, low in cholesterol and higher proteins, vitamins and minerals are good for children,women and diabetic patient. The protein content of the developed soy–mushroom–moringa soup powder was higher than that of the results of other studies (Rahman, Saifullah, & Islam, 2012; Rekha et al., 2010; Rubilar et al., 2012; Singh et al., 2003).Protein rich mushroom powder can be taken in diet with wheat and other grain flour.Microbial analysis of soy–mushroom–moringa soup powder were carried out according to the procedure of Bacteriological Analytical Manual (Feng, Weagant, Grant, & Burkhardt, 2013; Maturin & Peeler, 2001; Tournas, Stack, Mislivec, Koch, & Bandler, 2001).

Tomato-mushroom Ketchup made from *Pleurotus ostreatus* has good taste and can be stored upto 12 days whereas, it can be stored for longer period if preservatives are added.

*Pleurotus* mycelium can grow on fresh and fermented straw and it does not require composted substrate for growth. Substrate preparation for oyster mushroom is very simple. Further this mushroom does not require controlled environmental conditions like *A.bisporus* as most of the species have very wide temperature, relatively humidity and CO2 tolerance. *P. ostreatus* is also known as “oyster mushroom”, “hiratake”, “shimeji”, or “houbitake” (Mizuno and Zhuang 1995; Bononi et al. 1995; Rühl et al. 2008)

White button mushroom,has longer cultivation period in comparison to oyster mushroom.The oyster mushroom fruit bodies can be easily dried and stored.It can be stored upto one year in dried and powder form.In general, mushrooms contain 90% water and 10% dry matter (Morais et al. 2000;Sánchez 2004). Dried oyster mushrooms can be instantly used after soaking in hot water for 5 to 10 minutes or it can be used in powdered form for several preparations. Fresh mushrooms have a shelf life of 24-48 h even at room temperature.

# 5 Conclusion

Oyster mushroom is mushroom of economic importance could be grown in $25^0$C to $35^0$C.Oyster mushroom is rich source of proteins vitamins and minerals.Various value added products could be made from *Pleurotus ostreatus* and *Pleurotus-sajor-caju*.Mushroom soup powder,mushroom powder and ketchup can be produced on large scale.White oyster and colored oyster mushroom has short cultivation period and favorite among people.Oyster mushroom cultivation can fetch good economic returns.

# Declarations

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# Figures

**Figure 1**

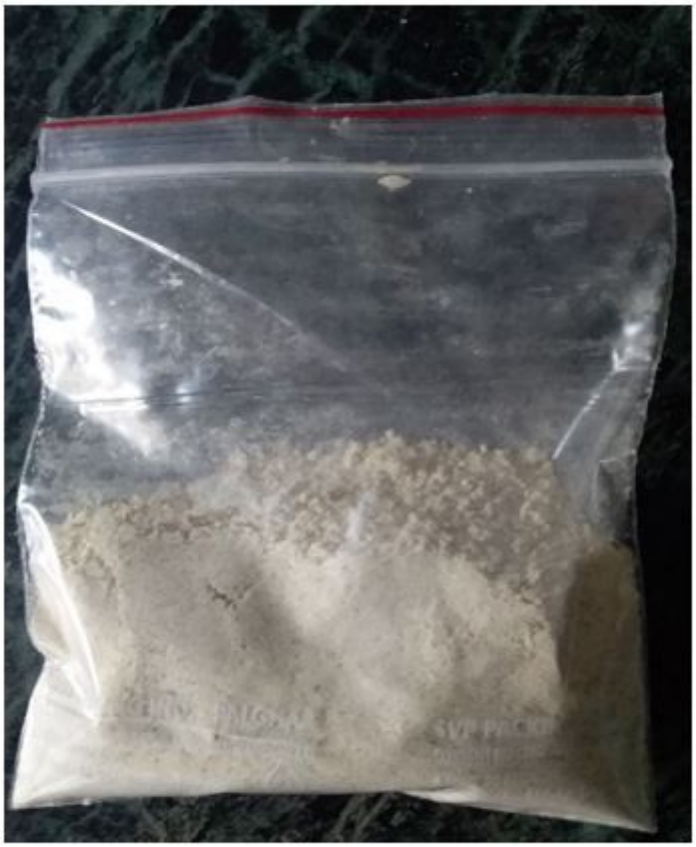
Pleurotus sajor-caju

**Figure 2**

Pleurotus ostreatus


**Figure 3**

Soup powder



Oyster mushroom powder

**Figure 4**

Oyster mushroom powder

**Figure 5**

Tomato-mushroom ketchup

**Figure 6**

dehydrated mushroom

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