

Oyster Mushroom Cultivation

Part II. Oyster Mushrooms

Chapter 5

Substrate

RUBBER TREE SAWDUST

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Rubber tree (*Hevea brasiliensis* (Willd ex. A. Juss.) Muell.- Arn.) is an industrial tree cultivated in some parts of the Highland and South-East Provinces of Vietnam such as Daklak, Gialai, Kontum, and Dongnai. Every year, a large number of rubber-exhausted trees are cut for new planting and for producing furniture from rubber wood. This results in a lot of sawdust waste that may cause serious environmental problems. For many years, that sawdust was either burned or naturally discharged, and now it is recognized to be very suitable for mushroom cultivation in Vietnam. Many mushroom species, such as *Pleurotus* spp., *Auricula* spp., *Lentinula* spp. and *Ganoderma* spp., are popularly cultivated on rubber tree sawdust. In this article we are going to deal with special methods for preparing rubber tree sawdust as a substrate material for oyster mushroom (*Pleurotus* spp.) cultivation.

The Rubber Tree Sawdust

Rubber tree sawdust has a uniform size structure so it is not only suitable for utilization in plastic bag cultivation, but the structure also facilitates enrichment of the substrate. In addition, the levels of nutritional elements in rubber tree sawdust are a little bit higher than those of mixed broad-leaf tree sawdust.

Table 1. Comparison of rubber tree sawdust and mixed broadleaf tree sawdust

Elements	Rubber tree Sawdust (%)	Mixed broad-leaf tree Sawdust (%)
N	1.68-0.20	1.27-0.20
P	0.48-0.04	0.43-0.06
K	1.18-0.05	0.77-0.05
Ca	0.12-0.03	0.23-0.06
Mg	0.04-0.01	0.03-0.01

(Source : *Studies on Biotransformation abilities of oyster mushroom*
- Master thesis by Tran Huu Do, 1999)

Table 2. Comparison of rubber tree sawdust and mixed broadleaf tree sawdust

Elements	Rubber tree Sawdust (ppm)	Mixed broad-leaf tree Sawdust (ppm)	Error (%)
As	0.03	0.22	5
Cd	0.05	< 0.14	-
Cs	1.1	1.66	10
Cu	23.83	13.29	5
Fe	113.76	167.85	5
Hg	0.01	0.07	25
Mn	31.26	41.13	5
Pb	2.08	1.75	10
V	0.22	0.16	10
Zn	31.28	28.79	3

(Source : *Studies on Biotransformation abilities of oyster mushroom*
- Master thesis by Tran Huu Do, 1999)

Substrate Formulation

Although the nutrients of the substrate always affect mushroom production, we still propose three substrate formulae for growing oyster mushrooms in Vietnam. Growers may choose the most convenient and appropriate formulae for each specific case. For example, the substrate formula number one is not recommended for any poorly equipped mushroom farm because of its high risk of contamination and formula number three is used only for fresh sawdust.

Formula 1 (T.H. Do, 1999)		Formula 2 (L. T. Chau, <i>et al.</i> , 2003)		Formula 3 (L.D. Thang, 1993)	
sawdust :	75%	sawdust :	85%	Sawdust :	99%
rice bran :	10%	rice bran :	10%	Lime :	1%
corn bran :	5%	lime :	1%		
lime :	2%	ammonium sulphate :	0.5%	(Only used for fresh sawdust)	
peanut waste	5%	sugar :	1%		
super phosphate :	1%	gypsum :	2%		
ammonium sulphate :	0.5%				
magnesium sulphate :	0.05%				

Treatment of Substrate



Figure 1. Sifting of sawdust



Figure 2. Rubber tree sawdust mixed with additives



Figure 3. Bags after bagging

The sawdust must be pre-wetted for 2-3 days in advance, and then shavings and pieces of wood that are too big or too sharp are removed by a sift (Fig. 1), because these pieces absorb water poorly and easily pierce plastic bags during handling. Rice and corn bran and peanut waste are supplemented as organic nitrogen sources while urea and ammonium sulphate as inorganic nitrogen sources. Lime should be diluted with water, and then showered onto the sawdust to adjust pH. Mix the components carefully and adjust the moisture content to 60-65% and the pH to 5.5-6.5 before filling the bags (Fig. 2).

Many kinds of plastic bags are used in Vietnam, and growers can choose the sizes of plastic bags according to the hygienic conditions and equipment of their mushroom farms.

After filling, the bags are closed by putting on a ring made of plastic or thick paper forming a 'mouth' (Fig. 3) inside which a cotton plug is put as a stopper, and the whole ring is then wrapped with a piece of old newspaper.

Sterilization

Sterilization of substrate bags is done under high pressure and high temperature using an autoclave, usually at 1 atm, 121 °C, for 60-90 minutes, depending on the volume of the bags.

Normal pressure sterilization is done in 95 °C for 5 hours in a drum (Fig. 4). As an alternative method for sterilization, bags can be sterilized twice at 95 °C, for 3 hours each time, with a 24-hour interval between treatments.



Figure 4. Drum for normal pressure sterilization



Figure 5. Bags after sterilization

Inoculation

Spawning is conducted in a clean room and some inoculation rooms are made of a plastic sheet in Vietnam. Growers buy mushroom spawn from the Institute of Biology or the Agriculture Center near their mushroom farms. Spawn is inoculated into substrate bags manually after disinfecting the gloves and bottlenecks with an alcohol flame. Spawn in 750g bottle is inoculated to 70-80 bags of 1kg each, so spawning rate reaches 1% of wet weight of substrate.

Incubation

Inoculated bags are hung by chains in a dark room at 25-30°C for incubation. Incubation periods vary according to the species: 20-25 days for *Pleurotus sajor-caju*, *Pleurotus pulmonarius*, and *Pleurotus ostreatus*, 30-40 days for *Pleurotus cystidiosus*, and 50-55 days for *Pleurotus eryngii*.

Fruiting

When the mycelium has covered the substrate completely, the bags are transported to the fruiting room, and then some slits are made around the plastic bags to accommodate fruit body formation. All the windows of the growing room are open for ventilation and light, and humidity is maintained by spraying water 3-4 times per day. In most developing countries including Vietnam, growing rooms don't have ventilation systems or temperature controls, so cultivation is absolutely dependent on natural conditions. Therefore, the temperature and humidity of a growing area should be thoroughly examined when choosing suitable species or strains.



Figure 6, 7. *Pleurotus pulmonarius* growing from rubber tree sawdust bags

Figure 8. *Pleurotus abalonus*



Figure 9. *Pleurotus cystidiosus*

Figure 10. Harvested oyster mushrooms

Harvest

In Vietnam, 4-5 flushes of oyster mushroom are harvested. The yield of *Pleurotus eryngii* is around 23-30% the weight of the dried substrate while the yield of *Pleurotus pulmonarius*, *Pleurotus sajor-caju* and *Pleurotus ostreatus* are higher, at about 40-50% of the weight of the dried substrate.

REFERENCES

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