The evaluation of using mushroom sawdust wastes for cultivation of *Pleurotus citrinopileatus*

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**ABSTRACT**

In the present study, sawdust wastes of *Lentinula edodes* and *Pleurotus sajor-caju* were used to partially replace sawdust as substrate components for the cultivation of *Pleurotus citrinopileatus*, and were comparative study on the mycelial growth and yield. The highest mycelial growth of mushroom on five different combative substrates was sawdust of *Mangifera indica* (CK), followed by sawdust of *M. indica* mixed with sawdust waste of *P. sajor-caju* (2:1, w/w). The crop gave a maximum biological efficiency of 38.6 % on sawdust of *M. indica* mixed with sawdust waste of *L. edodes* (2:1, w/w), followed by 34.1 % on sawdust of *M. indica* mixed with sawdust waste of *P. sajor-caju* (2:1, w/w). It indicated that the substrates of sawdust of *M. indica* supplemented with 50% sawdust waste of *L. edodes* and of *P. sajor-caju*, mushroom yield increased 20% and 6%, respectively, over that of sawdust of *M. indica* (CK). From the results of this study, the substrate of sawdust of *M. indica* supplemented with 50% sawdust waste of *L. edodes* appeared to be the best substrate for growing *P. citrinopileatus*.

**Key words:** cultivation, mushroom, *Pleurotus citrinopileatus*, sawdust waste.

**Introduction**

Recently, strong consumer’s demand has stimulated increased production of *P. citrinopileatus*, which is the new cultivated edible mushroom in Taiwan. Growing increase in consumption of *P. citrinopileatus* is largely due to its unique flavor and aromatic properties. Particularly, the cap of *P. citrinopileatus* is beautiful golden color, which attracts many people’s attention. Many reports indicated that this mushroom possessed medicinal properties. For example, some polysaccharide compounds have been extracted from both the fruiting body (Zhang *et al*., 1994) and mycelium (Wang *et al*., 2005) of *P. citrinopileatus*, and found to have antitumor activity. This mushroom also possessed fatigue resistance, immunity enhancing, delay aging (Wang *et al*., 2001), antigenotoxicity (Wang *et al*., 2005), and antioxidant activity (Hwang, 2003). It is significantly appeared that this mushroom has potential for researchers to develop its application on food and medicinal use.

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Pleurotus spp. are commonly grown on a wide range of lignocellulosic materials (Sa’nchez, 2004). Some experiments of the agricultural wastes studied as substrates for Pleurotus spp. are coffee industry residues (Fan et al., 2000), coffee pulp and wheat straw (Salmones et al., 2005), waste paper (Baysal et al., 2003). The substrates used in each region depend on the locally available agricultural wastes (Cohen et al., 2002). In Taiwan, sawdust is the popular basal ingredient used in synthetic formulations of substrate for producing mushroom. Especially, some mushroom growers use the sawdust of Mango (Mangifera indica), which is one of the important fruit trees in southern Taiwan, as the substrate for cultivation of Pleurotus sajor-caju and Ganoderma tsugae. Lentinula edodes and P. sajor-caju are two of the five most cultivated edible mushrooms in Taiwan, and over 100,000 tons of these two mushrooms sawdust wastes are generated each year. These mushroom sawdust wastes were partially used as organic fertilizer. However, large volumes of sawdust wastes can be found in the mushroom cultivated areas. These sawdust wastes are left to decay in the field, are disposed of through burning or are poured into the river. It has already become a strict impact to forest resources and environment, and this impact will continue to become more serious than before. Cultivation of mushrooms on these sawdust wastes may be one of the solutions to transform inedible wastes into edible biomass. Some authors attempted to evaluate the mushroom cultivation on compost waste, which showed the compost waste could be used to recultivate other edible mushrooms such as P. sajor-caju after cultivation of shiitake (Royse, 1992), and Coprinus comatus or Agaricus bisporus after cultivation of Ganoderma lucidum or Flammulina velutipes (Chen, 1998).

In order to decrease environmental impacts resulting from mushroom production, this study examines the effect of L. edodes and P. sajor-caju sawdust wastes on the production of P. citrinopileatus. In the previous papers, we described the effect of different compositions of sawdust substrate (Liang and Wu, 2002a) and liquid spawn (Liang and Wu, 2002b) on the yield of P. citrinopileatus. Based on the above results, five formulas of sawdust substrate, some mixed with sawdust waste from these two mushrooms, were used in this study.

Materials and Methods

Organism

Pleurotus citrinopileatus (supplied by You-Hao Mushroom Research Institute, China) was grown on PDA at 25°C for regular subculture and maintained on PDA at 4°C for a maximum of 3 months.

Liquid spawn preparation

Culture conditions were basically the same as in the previous paper (Liang and Wu, 2002b). Pleurotus citrinopileatus was precultured on PDA at 25°C and mycelium was harvested after 7 days. Mycelial fragments from two plates (9 cm) were transferred into 100 mL of sterilized water and homogenized with a waring blender. Liquid cultures were grown using 5 mL of this suspension as inoculum into 500-mL flasks containing 150 mL of medium (20 g/L glucose, 5 g/L yeast extract, 1 g/L KH₂PO₄, 0.5 g/L MgSO₄·7H₂O). And the flasks were shaken under 150 rpm at 25°C for 7 days on an orbital shaker. The liquid products of the
mycelial culture were directly used as liquid spawn.

**Substrate preparation and inoculation**

Both sawdust of *M. indica* and sawdust waste of *P. sajor-caju* were supplied by Yu-Ho Mushroom Farm, Ligang, Pingtung in Taiwan. Sawdust waste of *L. edodes* was supplied by Chen Mushroom Farm, Shinshe, Taichung in Taiwan. Sawdust of *M. indica* was fermented for 3 months before preparing substrate. The sawdust wastes of *L. edodes* and *P. sajor-caju* were collected after the ending of harvest time of these two mushrooms, respectively, and were stored in a bucket until they were used.

Dry substrate weights were determined by heating 100 g of freshly prepared substrate at 105°C for 24 h (Royse, 2002). The calculated dry weight was subsequently used to determine the biological efficiency in percentage. The sawdust substrate formulation (Table 1) was mixed with 10% of rice bran by weight and the water content of the mixture was adjusted at ca. 60% and its acidity was adjusted at pH 6.0 with calcium carbonate or ammonia sulfate. The mixture was then filled into 850 mL polypropylene plastic bottle and sterilized at 121°C for 60 min. After cooling down to room temperature, the sterilized substrate was inoculated with 5 mL of the liquid spawn. The inoculated substrates were incubated at 25°C and 70% relative humidity and were placed on shelves in a dark room. The spawn run period to total colonization (the number of days from inoculation to complete colonization of the substrate by the mycelium), time to first primordia and first flush, and mushroom size were recorded. The experiments were a completely randomized design with 16 replicates per treatment.

**Incubation and cropping**

After the primordia were appeared on the top layer of substrate in each bottle, then the bottle was moved to a cropping room of which temperature was controlled at 28°C, relative humidity at 80% above and light intensity at about 200 lux. The cropping room was watered intermittently to maintain the moisture during the cropping time.

**Harvesting and determination of biological efficiency**

Fruiting bodies in each bottle were harvested when the diameter of mushroom caps grow to 1–2 centimeter. The harvested fruiting bodies were then counted and weighed. At the end of

<table>
<thead>
<tr>
<th>Substrate*</th>
<th>Composition of sawdust substrate mixtures (% w/w)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>No. 2 (CK)</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>No. 3</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>No. 4</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>No. 5</td>
<td>90</td>
<td>10</td>
</tr>
</tbody>
</table>

*No. 1: sawdust waste of *L. edodes*; No. 2: control, sawdust of *M. indica* fermented for 3 months; No. 3: sawdust of *M. indica* mixed with sawdust waste of *L. edodes* (2:1, w/w); No. 4: sawdust of *M. indica* mixed with sawdust waste of *P. sajor-caju* (2:1, w/w); No. 5: sawdust waste of *P. sajor-caju*. Each substrate consisted of 16 bottles.
the harvest period, the accumulated data were used to calculate the biological efficiency. Biological efficiency was determined as the weight ratio of fresh mushrooms harvested per unit of dry substrate and expressed as a percentage.

Statistical analysis
Each data value was presented as the mean ± S.D. Differences between the means of individual groups were assessed by one-way ANOVA with Duncan’s multiple-range test.

Results

Days of mycelial growth and mushroom production
The period for spawn to fully colonize the substrates had significant difference among treatments were shown in Table 2. The period of *P. citrinopileatus* colonized the substrate of sawdust of *M. indica* (substrate no. 2, CK) was 15.9 days, followed by the substrate of sawdust of *M. indica* mixed with sawdust waste of *P. sajor-caju* (2:1, w/w) (substrate no. 4) was 18.1 days. There was 34.3 days, however, in the case of the substrate of sawdust waste of *L. edodes* (substrate no. 1). The densities of mycelial growth were uniform and white on substrate no. 2, no. 3 and no. 4. Mycelial growth for substrate no.1, no. 2, no. 3 and no. 4 were not significantly different (P < 0.05) from each other.

Time to the appearance of primordia for the substrates was from 24.9 days to 28.8 days (Table 3). The appearance of primordia before the liquid spawn fully colonized the substrates were seen on the substrate of sawdust waste of *L. edodes* (substrate no. 1), of sawdust of *M. indica* mixed with sawdust waste of *L. edodes* (2:1, w/w) (substrate no. 3) and of sawdust waste from *P. sajor-caju* (substrate no. 5). The substrate of sawdust of *M. indica* (substrate no. 2, CK) gave the fastest mycelial growth rate, however, this did not correspond with the appearance of primordia. The first flush started 3.1–5.5 days after the appearance of primordia. This varied from substrate to substrate. There was no significant difference (P < 0.05) in substrate no.1, no. 2, no. 3, and no. 4 on time to first primordia and time to first flush.

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Mycelial density**</th>
<th>Mycelial growth (mm/day)</th>
<th>Time to spawn fully colonizing the substrate (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No 1</td>
<td>+ +</td>
<td>5.8 ± 0.5&lt;sup&gt;ab&lt;/sup&gt;***</td>
<td>34.3 ± 3.0&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>No 2 (CK)</td>
<td>+ + +</td>
<td>12.6 ± 2.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>15.9 ± 2.9&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>No 3</td>
<td>+ + +</td>
<td>6.8 ± 0.3&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>29.5 ± 1.1&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>No 4</td>
<td>+ + +</td>
<td>11.0 ± 1.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>18.1 ± 2.5&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>No 5</td>
<td>+ +</td>
<td>6.8 ± 0.4&lt;sup&gt;bc&lt;/sup&gt;</td>
<td>29.5 ± 1.9&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

* No. 1: sawdust waste of *L. edodes*; No. 2: control, sawdust of *M. indica* fermented for 3 months; No. 3: sawdust of *M. indica* mixed with sawdust waste of *L. edodes* (2:1, w/w); No. 4: sawdust of *M. indica* mixed with sawdust waste of *P. sajor-caju* (2:1, w/w); No. 5: sawdust waste of *P. sajor-caju*.

** Degree of mycelial density when the mycelia fully colonises the substrate: (+) poor running growth, (+ +) mycelium grows throughout the whole bottle but is not uniformly white, (+ + +) mycelium grows throughout the whole bottle and is uniformly white

*** Data are analyzed by Duncan Multiple Range Test. Means within a column followed by same letter are not significantly different at 5% level of probability.
Table 3. Comparison of time to first primordia and first flush, mushroom size, yield, and biological efficiency for *Pleurotus citrinopileatus* grown on different substrates

<table>
<thead>
<tr>
<th>Substrate*</th>
<th>Time to first primordia (days)</th>
<th>Time to first flush (days)</th>
<th>Size (g)</th>
<th>Yield (g/bottle)</th>
<th>B.E. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No 1</td>
<td>26.4 ± 2.0a**</td>
<td>31.9 ± 3.8a</td>
<td>23.3 ± 4.5b</td>
<td>52.9 ± 2.2b</td>
<td>22.8 ± 1.0b</td>
</tr>
<tr>
<td>No 2 (CK)</td>
<td>25.9 ± 2.1ab</td>
<td>29.6 ± 3.2ab</td>
<td>27.7 ± 5.4a</td>
<td>74.8 ± 4.6a</td>
<td>32.2 ± 2.0a</td>
</tr>
<tr>
<td>No 3</td>
<td>26.1 ± 1.3ab</td>
<td>31.1 ± 2.2ab</td>
<td>25.1 ± 3.8a</td>
<td>89.6 ± 3.6a</td>
<td>38.6 ± 1.6a</td>
</tr>
<tr>
<td>No 4</td>
<td>24.9 ± 2.2ab</td>
<td>28.0 ± 3.5a</td>
<td>29.3 ± 5.8a</td>
<td>79.2 ± 5.0c</td>
<td>34.1 ± 2.2a</td>
</tr>
<tr>
<td>No 5</td>
<td>28.8 ± 1.6b</td>
<td>33.0 ± 4.1b</td>
<td>19.9 ± 5.7c</td>
<td>44.8 ± 5.0b</td>
<td>19.3 ± 2.1b</td>
</tr>
</tbody>
</table>

* No. 1: sawdust waste of *L. edodes*; No. 2: control, sawdust of *M. indica* fermented for 3 months; No. 3: sawdust of *M. indica* mixed with sawdust waste of *L. edodes* (2:1, w/w); No. 4: sawdust of *M. indica* mixed with sawdust waste of *P. sajor-caju* (2:1, w/w); No. 5: sawdust waste of *P. sajor-caju*.

** Data are analyzed by Duncan Multiple Range Test. Means within a column followed by same letter are not significantly different at 5% level of probability.

Mushroom size

Mushroom size in a 60 days’ cropping period is shown in Table 3. There were no significant differences in mushroom size for the 1st and 2nd flush of all substrates. However, mushroom size for the 3rd flush and after this period was generally smaller compared to that of the 1st and 2nd flush. The average mushroom size in the cropping period gave the largest size of 29.3 g on the substrate of sawdust of *M. indica* mixed with sawdust waste of *P. sajor-caju* (2:1, w/w, substrate no. 4), followed by 27.7 g on the substrate of sawdust of *M. indica* (substrate no. 2, CK). Mushroom size for substrate no. 2, no. 3, and no. 4 were not significantly different (P < 0.05) from each other.

Yield and biological efficiency

During the 60 days’ cropping period, the maximum yield of mushroom on 580 g wet substrate was recorded on the substrate of sawdust of *M. indica* mixed with sawdust waste of *L. edodes* (2:1, w/w, substrate no. 3) with a biological efficiency of 34.1%. Biological efficiency of mushroom production varied in different substrates. It indicated that the substrate of sawdust of *M. indica* mixed with sawdust waste of *L. edodes* (2:1, w/w) was superior to all the other substrates. Yield for substrate no. 2, no. 3, and no. 4 were not significantly different (P < 0.05) from each other.

Yield at different flush and total yield per crop

Data on the yield of each flush were presented in Table 4. It showed five flushes in the cropping time for the substrate of sawdust of *M. indica* mixed with sawdust waste of *L. edodes* (2:1, w/w, substrate no. 3) and of sawdust of *M. indica* mixed with sawdust waste of *P. sajor-caju* (2:1, w/w, substrate no. 4), however, only four flushes for the substrate of sawdust waste of *L. edodes* (substrate no. 1), of sawdust of *M. indica* (substrate no. 2) and of sawdust waste from *P. sajor-caju* (substrate no. 5). In different flushes for all substrates, the maximum yield was given by the 2nd flush, except the substrate of sawdust of *M. indica* (sub-
Table 4. Yield (g/bottle) at different flush of \textit{P. citrinopileatus} grown on different substrates

<table>
<thead>
<tr>
<th>Flush</th>
<th>Substrate no.</th>
<th>No. 1</th>
<th>No. 2</th>
<th>No. 3</th>
<th>No. 4</th>
<th>No. 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>No. 1: sawdust waste of \textit{L. edodes}; No. 2: control, sawdust of \textit{M. indica} fermented for 3 months; No. 3: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{L. edodes} (2:1, w/w), No. 4: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{P. sajor-caju} (2:1, w/w), No. 5: sawdust waste of \textit{P. sajor-caju}</td>
<td>10.2&lt;sup&gt;b&lt;/sup&gt;**</td>
<td>35.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.0&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>2nd</td>
<td>No. 1: sawdust waste of \textit{L. edodes}; No. 2: control, sawdust of \textit{M. indica} fermented for 3 months; No. 3: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{L. edodes} (2:1, w/w), No. 4: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{P. sajor-caju} (2:1, w/w), No. 5: sawdust waste of \textit{P. sajor-caju}</td>
<td>27.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>23.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>29.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>31.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>24.9&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>3rd</td>
<td>No. 1: sawdust waste of \textit{L. edodes}; No. 2: control, sawdust of \textit{M. indica} fermented for 3 months; No. 3: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{L. edodes} (2:1, w/w), No. 4: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{P. sajor-caju} (2:1, w/w), No. 5: sawdust waste of \textit{P. sajor-caju}</td>
<td>12.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>21.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8.3&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>4th</td>
<td>No. 1: sawdust waste of \textit{L. edodes}; No. 2: control, sawdust of \textit{M. indica} fermented for 3 months; No. 3: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{L. edodes} (2:1, w/w), No. 4: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{P. sajor-caju} (2:1, w/w), No. 5: sawdust waste of \textit{P. sajor-caju}</td>
<td>2.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.6&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>5th</td>
<td>No. 1: sawdust waste of \textit{L. edodes}; No. 2: control, sawdust of \textit{M. indica} fermented for 3 months; No. 3: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{L. edodes} (2:1, w/w), No. 4: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{P. sajor-caju} (2:1, w/w), No. 5: sawdust waste of \textit{P. sajor-caju}</td>
<td>0.0</td>
<td>0.0</td>
<td>7.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.0</td>
</tr>
<tr>
<td>Total yield</td>
<td>No. 1: sawdust waste of \textit{L. edodes}; No. 2: control, sawdust of \textit{M. indica} fermented for 3 months; No. 3: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{L. edodes} (2:1, w/w), No. 4: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{P. sajor-caju} (2:1, w/w), No. 5: sawdust waste of \textit{P. sajor-caju}</td>
<td>52.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>74.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>89.6&lt;sup&gt;a&lt;/sup&gt;</td>
<td>79.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>44.8&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

No. 1: sawdust waste of \textit{L. edodes}; No. 2: control, sawdust of \textit{M. indica} fermented for 3 months; No. 3: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{L. edodes} (2:1, w/w), No. 4: sawdust of \textit{M. indica} mixed with sawdust waste of \textit{P. sajor-caju} (2:1, w/w), No. 5: sawdust waste of \textit{P. sajor-caju}.

** Data are analyzed by Duncan Multiple Range Test. Means within a column followed by same letter are not significantly different at 5 % level of probability.

Discussion

In the present study, mycelial growth, yield and biological efficiency were evaluated in relation to the control substrate partially supplemented sawdust wastes of \textit{L. edodes} and \textit{P. sajor-caju}. Among the five formula substrates for the cultivation of \textit{P. citrinopileatus}, substrate no. 2 (sawdust of \textit{M. indica}) gave the fastest mycelial growth, however, this did not correspond with time to primordial formation, time to first crop, mushroom size and yield. It indicated that mycelial growth and production of \textit{P. citrinopileatus} had different requirements. These results were similar to that rice husk for \textit{P. ostreatus} (Obodai et al., 2003).

Baysal et al. (2003) reported that slow spawn running and low yield for \textit{P. ostreatus} on waste paper might be due to supplement with excessive nitrogen of chicken manure. Moreover, Chen (1998) reported that the total nitrogen content in the sawdust waste increased 10% over pre-cultivation for mushroom cultivation. The present study also showed that the same results on substrate no. 1 and no. 5 of which only contained sawdust wastes of \textit{L. edodes} and \textit{P. sajor-caju}. It appeared that sole sawdust waste of mushroom as substrate could be inappropriate to re-cultivate \textit{P. citrinopileatus}. However, the mushroom yield was significantly greater in sawdust of \textit{M. indica} supplemented with 50% sawdust waste than in sawdust of \textit{M. indica} in the present study. As the substrates of sawdust of \textit{M. indica} supplemented with 50% sawdust waste of \textit{L. edodes} or \textit{P. sajor-caju}, respectively, mushroom yield increased 20% and 6% than that of sawdust of \textit{M. indica} only. Results indicated that addition of sawdust waste of \textit{L. edodes} or \textit{P. sajor-caju} to the sawdust of \textit{M. indica} increased yield compared to sole sawdust waste of \textit{L. edodes} or \textit{P. sajor-caju}. These results were consistent with the finding of Baysal et al. (2003). Yield of the first two flushes
was obtained more over 60% in all substrates except substrate no. 3. This result was near to the finding of Obodai et al. (2003) that was obtained more over 70% in all the by-product substrates for P. ostreatus cultivation.

Chen (1998) reported that mycelial growth of *Coprinus comatus* or *Agaricus bisporus* on the spent substrate was faster than that on the fresh compost, however, the yield and bioconversion rate was slightly lower, production cost could be cut down about 60%. Obodai et al. (2003) also reported using rice straw as substrate for *P. ostreatus* cultivation; it gave relatively good yields and that could be an alternative substrate for cultivation of *P. ostreatus*. In the present study, although mycelial growth on the waste was slower than that on the fresh sawdust substrate, however, the yield and biological efficiency was significantly higher which it was mixed with fresh sawdust. It indicated that production cost for the cultivation of *P. citrinopileatus* could be cut down under this experiment. Furthermore, this recycling method seems that it can increase economic efficiency.

**References**


利用菇類木屑廢棄物栽培金頂側耳的評估

梁志欽1 吳秋暘2 王進琦3

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2. 東方技術學院食品科技系
3. 大仁技術學院食品科技系

摘 要

本研究以香菇和秀珍菇的木屑廢棄物部分取代木屑培養基，進行金頂側耳的實驗室栽培。結果顯示，在5種不同的培養基中，菌絲生長期以芒果樹木屑為培養基 (控制組) 的生長速率最快，秀珍菇廢木屑和芒果樹木屑以 1:2 比例 (w/w) 混合的培養基次之。由菇期以香菇廢木屑和芒果樹木屑以 1:2 比例 (w/w) 混合的培養基，其生物效率最高，達 38.6%，產量較對照組多 20%；秀珍菇廢木屑和芒果樹木屑以 1:2 比例 (w/w) 混合的培養基次之，生物效率達 34.1%，產量則較對照組多 6%。以上結果顯示，以香菇木屑廢棄物部分取代木屑培養基栽種金頂側耳具可行性。

關鍵詞：木屑廢棄物、金頂側耳、栽培、菇類。