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A study on lignolytic property of fungal isolates using phenol red

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ABSTRACT

Seven fungal isolates include Trichoderma spp, Penicillium spp, Aspergillus niger, Botrytis spp, Rhizopus spp, Aspergillus fumigatus and Cladosporium spp2 were characterized for their activity to degrade lignin analogue i.e., phenol red with various growth conditions such as various concentrations of phenol red (0.25, 0.50, 0.75, 1.0 and 1.25%), different temperature (28°C, 37°C and 45°C) and various pH (acidic, neutral and alkaline) conditions. The fungal isolates such as Penicillium spp, Aspergillus niger, Aspergillus fumigatus and Trichoderma spp were showed the better lignolytic activity at a concentration of 1.0 percent phenol red in the acidic (pH 6.0) and neutral (pH 7.0) conditions at 28°C.

Key words: Decayed sawdust, lignolytic fungi, malt extract medium, phenol red

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INTRODUCTION

Lignin is the major noncarbohydrate, polyphenolic structural constituent of wood and other plant material that encrusts the cell walls and cements the cells together. The aromatic polymer, lignin is well-known for resistance to microbial degradation because of its high molecular weight and presence of various biologically stable carbon-to-carbon and ether linkages. However, certain fungi are capable to degrade plant lignin via an oxidative process (Tien and Kirk, 1983). The important lignin degrading fungi are *Clavaria, Clitocybecollybia, Flammula, Hypholoma, Lepiota, Mycena, Pleurotus, Agaricus, Polyporus, Fusarium, Arthrobotrys, Poria, Pholiota, Cephalosporium, Collybi*, and *Humicola* (Atlas and Bartha, 1998). It is reported that all the three specific lignolytic enzymes such as laccase, lignin peroxidase and manganese peroxidase are present in *Pleurotus* spp (Velazuez-Cedeno et al., 2002). The secretion of ligninolytic enzymes, the ligninolytic system of this fungus remains unknown. In this study, lignolytic properties of fungal isolates are characterized.

MATERIALS AND METHODS

The decayed sawdust sample was collected from the dumping yard near sawdust industry, Thenkarai Periyakulam, Theni (District), Tamil Nadu, India. The samples were collected at four different spots randomly and blended uniformly. From this seven fungal isolates were selected for lignolytic study (Mahalingam and Daniel, 2007).

Characterization of selected lignolytic fungi

Malt extract medium was prepared with various buffered solutions, using acetate buffer (pH 6.0) and phosphate buffer (pH 7.0) and tris-Hcl buffer (pH 8.0). The medium of each pH was supplemented with increasing concentrations of phenol red (source of lignin) i.e., 0.25, 0.50, 0.75, 1.0 and 1.25 percent. The medium was sterilized and the seven selected fungal isolates were separately inoculated. Then the inoculated plates were incubated in

different sets at various temperature such as 28°C, 37°C and 45°C. The growth performances of the seven fungal isolates were observed in all the growth conditions on 7d and the results were recorded.

RESULTS AND DISCUSSION

Characterization of selected lignolytic fungi

The observations on the growth performance of the seven selected lignolytic fungal isolates in the acidic (pH 6.0), neutral (pH 7.0) and alkaline (pH 8.0) conditions with various concentrations of phenol red at three different temperatures are given in Tables 1, 2 and 3. The growth performance of fungal isolates varied in different concentrations of phenol red, temperatures and pH. Among the seven fungal isolates, *Penicillium* spp, *Aspergillus niger, A. fumigatus* and *Trichoderma* spp showed good growth performance at 28°C with 1.0 percent phenol red in the acidic (pH 6.0) and in the neutral (pH 7.0) conditions (Tables 1 and 2). Mahalingam and Daniel (2007) Isolated lignin degrading fungi such as *Penicillium spp, Fusarium spp and Aspergillus spp* from termite gut and partially characterized their growth parameter against different pH condition such as pH 4, 7 and 8.

Table 1: Growth performance of the seven selected lignolytic fungi grown in Malt extract agar medium containing various concentrations of phenol red at three different temperatures in acidic condition (pH 6.0) on 10d

Growth temperature (^{0}C)	Phenol red concentration (%)	Diameter of fungal growth (cm)						
		Trichoderma spp	*Penicillium* spp	*Aspergillus niger*	*Botrytis* spp	*Rhizopus* spp	*Aspergillus fumigatus*	*Cladosporium* spp2
28	0.25	1.6	1.9	1.7	1.3	1.5	2.0	1.1
	0.50	1.7	2.0	1.9	1.5	1.7	2.2	1.3
	0.75	1.9	2.2	2.0	1.7	1.8	2.4	1.6
	1.00	2.1	2.4	2.2	1.9	2.0	2.5	1.8
	1.25	1.7	2.0	1.8	1.4	1.6	2.1	1.2
37	0.25	1.3	1.4	1.5	1.2	1.3	1.6	1.0
	0.50	1.3	1.5	1.6	1.3	1.4	1.7	1.1
	0.75	1.4	1.6	1.7	1.4	1.5	1.9	1.3
	1.00	1.5	1.9	1.8	1.6	1.7	2.0	1.4
	1.25	1.2	1.5	1.5	1.4	1.3	1.6	1.2
At 47^{0}C, None of the organism showed growth								

Table 2: Growth performance of the seven selected lignolytic fungi grown in Malt extract agar medium containing various concentrations of phenol red at three different temperatures in neutral condition (pH 7.0) on 10d

Growth temperature (^{0}C)	Phenol red concentration (%)	Diameter of fungal growth (cm)						
		Trichoderma spp	*Penicillium* spp	*Aspergillus niger*	*Botrytis* spp	*Rhizopus* spp	*Aspergillus fumigatus*	*Cladosporium* spp2
28	0.25	1.4	1.7	1.5	1.2	1.4	1.8	1.0
	0.50	1.5	1.9	1.7	1.4	1.5	2.0	1.2
	0.75	1.7	2.1	1.8	1.5	1.6	2.2	1.4
	1.00	1.9	2.2	2.0	1.6	1.8	2.3	1.5
	1.25	1.6	1.8	1.6	1.4	1.5	1.9	1.2
37	0.25	1.1	1.4	1.3	1.0	1.2	1.5	0.9
	0.50	1.2	1.5	1.4	1.2	1.3	1.6	1.1
	0.75	1.4	1.7	1.6	1.3	1.5	1.8	1.2
	1.00	1.5	1.8	1.7	1.4	1.6	1.9	1.4
	1.25	1.3	1.5	1.4	1.1	1.3	1.7	1.0
At 47^{0}C, None of the organism showed growth								

Table 3: Growth performance of the seven selected lignolytic fungi grown in Malt extract agar medium containing various concentrations of phenol red at three different temperatures in alkaline condition (pH 8.0) on 10d

Growth temperature (^{0}C)	Phenol red concentration (%)	Diameter of fungal growth (cm)						
		Trichoderma spp	*Penicillium* spp	*Aspergillus niger*	*Botrytis* spp	*Rhizopus* spp	*Aspergillus fumigatus*	*Cladosporium* spp2
28	0.25	1.3	1.5	1.4	1.1	1.2	1.6	0.9
	0.50	1.4	1.6	1.5	1.2	1.4	1.8	1.0
	0.75	1.6	1.7	1.7	1.4	1.5	2.0	1.2
	1.00	1.7	1.9	1.8	1.5	1.6	2.1	1.3
	1.25	1.3	1.7	1.6	1.3	1.4	1.8	1.1
37	0.25	1.1	1.3	1.2	1.0	1.1	1.4	0.7
	0.50	1.2	1.4	1.3	1.1	1.2	1.5	0.9
	0.75	1.3	1.6	1.5	1.2	1.4	1.7	1.0
	1.00	1.5	1.8	1.6	1.4	1.5	1.9	1.2
	1.25	1.2	1.5	1.4	1.3	1.2	1.6	1.3
At 47^{0}C, None of the organism showed growth								

CONCLUSION

Seven fungal strains such as *Trichoderma* spp, *Penicillium* spp, *Aspergillus niger*, *Botrytis* spp, *Rhizopus* spp, *Aspergillus fumigatus* and *Cladosporium* spp2 isolated from decayed sawdust showed better lignolytic activity against different growth conditions such as temperature, pH and substrate concentration. Hence these organisms could be used commercially in the rapid degradation of lignolytic rich waste material into nutrient rich organic manures through composting and vermicomposting for sustainable agricultural practice in Rural area.

REFERENCES

[1] RM Atlas and R Bartha, (**1998**), Biogeochemical cycling, *In: Microbial Ecology (4th Ed.)*, An imprint Addison Wesley Longman Inc, Sydney, 403 - 405.
[2] PU Mahalingam and T Daniel, (**2007**), *Journal of Pure and Applied Microbiology*. 1(2): 327-330.
[3] M Tien, and Kirk TK, (**1983**), Lignin-degrading enzymes from himenomycete Phanerochaete chrysosporium Burds, *Sci*, 221, 661-663.
[4] MA Velazuez-Cedeno, G Mata and JM Savoie, (**2002**), *World J. Microbiol. Biotech,* 18,201-207.