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Dye decolourisation of textile effluent using mycelial biomass of *pleurotus florida* and *calocybe indica*

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ABSTRACT

Mycelial biomass of the selected macro fungi namely *Pleurotus florida* and *Calocybe indica* were tested for the dye decolorisation using spectrophotmetry over a period of seven days. Among the two mushrooms selected, *Pleurotus florida* recorded maximum decolourisation potential with carbon source. The decolorisation efficiency of *Pleurotus florida* was observed to be 29.70%,50.39% and 64.15% in treatments with 1%,2%,3% carbon source, while *Calocybe indica* recorded decolourisation of 27.52%,35.44% and 41.38% in 1%,2%,3% carbon source.The study revealed that the macro fungi give scope for decolorisation of dye effluent.

Introduction

Rapid industrialization and urbanization resulted in the manufacture and usage dyes that are synthetic and aromatic molecular compounds. According to their dissociation in an aqueous solution, dyes can be classified as acid, direct reactive dyes (anionic),basic dyes(cationic) and disperse dyes(nonionic).They are used in food, cosmetics, paper, plastic and textile industries and solutions retain them by physical adsorption by making compounds with metals and salts using covalent bonds. Many chemical dyes have been used increasingly in textile and dyeing industries because of their ease and cost effectiveness in synthesis, firmness and variety in colour compared to that of natural dyes. About 10,000 commercial dyes are manufactured including several varieties dyes such as acidic,basic,reactive, azo,diazo, anthroquinone based meta complex dyes. Over 10,000 dyes with an annual production of over $7X10^5$ metric tons are commercially available (Campose et al.,2001). Approximately 50%of the dyes are released as industrial effluents (Zollinger,1991). Azo dyes, an entirely new family of commercially produced dyes used in textile industry are not degraded and stable even in an exposure to light and washings(Cripps et al.,1990).Dye effluent may contain chemicals that are toxic, carcinogenic, mutagenic or teratogenic to various microbes, fish and mammalian species (Jaochin et al.,1985; Cameron et al.,1987).Most conventional waste water treatment systems such as coagulation(Yoshida et al.,1991),flocculation (Pansued and Wonngehaisuwan,1986), reverse osmosis (Waters,1984) techniques do not seem to result in any economic advantage. However biological processes are reported to be more effective compared to other methods (Rajasekaran et al., 2001).

Recently many studies showed that the white rot fungi have the ability to lignin degradation and also used to decolorize the polymeric dyes like crystal violet (Nagarajan and Annadurai, 1999).Based on these facts, the present study is proposed to analyze the dye decolorisation by using macro fungi.

Materials and Methods

The effluent samples were collected from the dye industries, Dindigul district, Tamil Nadu. The physico, chemical and biological characteristics of the dye effluent samples were examined using standard methods (Trivedi & Goel , 1986).

Collection of mushroom fruit bodies

The fruit bodies of macrofungi namely Pleurotus florida and Calocybe indica obtained from nearby mushroom farms were subjected for pure culture preparation using standard methods (Sivaprakasam et al.,1981).

Dye decolorisation study

In this study two methods were followed individually. In the first method, the dye effluent was treated with mycelium of chose mushrooms such as Pleurotus florida ;Calocybe indica with carbon source at the level of 1%,2% and 3% and the control without carbon source also maintained .In the second method, the effluent was treated with the mycelium of the chosen macrofungi without carbon source. The mixtures were kept in shaker and incubated at room temperature. The OD values were calculated and % of decolorisation was calculated as under

% of dye decolourisation=Initial absorbance—Final absorbance/ Initial absorbance The details of different treatments are as below

C-Control;

T1P (1%)-Pleurotus mycelium +Effluent+1% carbon source

T1P (2%)-Pleurotus mycelium +Effluent+2% carbon source

T1P (3%)-Pleurotus mycelium +Effluent+3% carbon source

T2P- Pleurotus mycelium

T1C(1%)-Calocybe mycelium +Effluent+1% carbon source

T1C(2%)-Calocybe mycelium +Effluent+2% carbon source

T1C(3%)-Calocybe mycelium +Effluent+3% carbon source

T2C(1%)-Calocybe mycelium +Effluent

Results and Discussion

The physico, chemical and biological characters of textile dye effluent are given in Table1.

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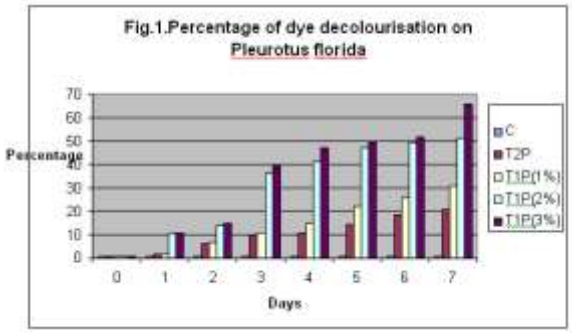
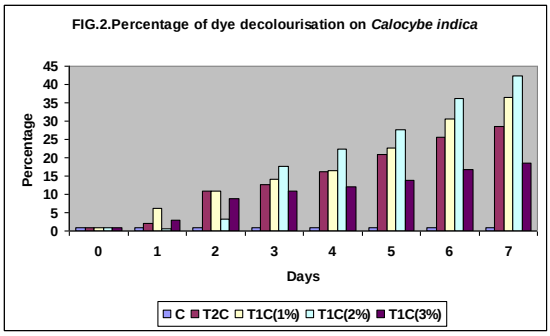
Dye decolorisation study

The dye decolorisation of the effluent was determined from the absorbance of the culture supernatant at wavelength of 560nm.On the 7th day, Pleurotus florida supplemented with carbon source has recorded 64.15%,50.39% and 29.70% decolorisation while the same species recorded 19.80% decolourisation without carbon source; the details are given in Fig1.



Similarly on 7th recorded Calocybe indica has recorded 41.38%, 35.44% and 27.52% of decolourisation with carbon source of 3%, 2%, 1% carbon level. While it was In second method the percentage of decolorisation 17.62% in treatment without carbon source (fig2).



The results show that the mycelial biomass of *Pleurotus florida and Calocybe indica* are capable of decolorizing the dye effluent with and without carbon source. Supplementation of more carbon source resulted in more percentage of decolourisation. Both the macro fungi have the capacity to decolourise the dye effluent. This study shows that *Pleurotus florida* has more efficiency to decolorize the dye effluent.

Discussion

Fungi from the basidiomycetes group, known as white rot fungi, a heterogeneous group of microorganisms have the capacity to degrade lignin as well as other wood component through laccases (Kirk and Farrell 1987). Laccases are involved in the biodegradation of lignin which constitute the main noncarbohydrate component in wood and are among the most abundant groups of biopolymers in the biosphere.

Fungal laccases as part of the lignolytic enzyme systems are produced by almost all wood and litter transforming basidiomycetes. These are the group of N-glycosylated extracellular blue oxidases with molecular masses of 60-390 KDA (Call and Micke, 1999). *Pleurotus ostreatus* secrete various types of phenol degrading enzymes which were reported to decolorize enzymes of the paper mill effluent (Kaviarasan&Natarajan,1996).So also *Tricholoma lobayanse* showed dye, acid green up to 80%(Kaviarasan Lalitha kumari,1999).

Conventional waste water treatment plants are unable to perform a complete dye removal; 90% of reactive textile dyes, persist even after activated sludge treatment.So also other physico chemical methods for waste water decolorisation have shortcomings due to high costs operational problems with less efficiency. Now a days effective biological processes, would be of great value due to their inexpensive, ecofriendly nature and lesser sludge producing properities.

The present study reveals the potentials of macrofungi namely *Pleurotus florida,Calocybe indica* for decolourisation of dye effluent. The results would stimulate interest and investigations into the development and adoption of ecofriendly, biological treatment of colored dye effluent.

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Table1 Physico, chemical and biological characters of textile dye effluent

S.No	Parameters	Values
1.	pH	7.6
2.	Temperature	27^0C
3.	Colour	Dark Brown
4.	Odour	Unpleasent
5.	Electrical Conductivity	1800 mhos
6.	Hardness	260mg/l
7.	Calcium	360mg/l
8.	Chloride	34mg/l
9.	Sulphate	68mg/l
10.	Total Solids	52.43g
11.	Total Dissolved Solids	53.01g
12.	Total Suspended solids	300mg/l
13.	Dissolved Oxygen	5.252mg/l
14.	Alkalinity	18mg/l
15.	BOD	8.7mg/l
16.	COD	1200mg/l