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Biodegradation of malachite green by wild mushroom of Chhatisgrah

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Abstract

The release of dye in to environment is of great concerned due to color, toxicity, mutagenicity species and carcinogenicity of the dye, considerable attention has been given in evaluating the capability of microorganism in decolourisation and biosportion of dye. In this study we take seven wild mushroom cultures *Pleurotus florida*, *Pleurotus sajorkaju*, *Grifola frondosa*, *Polyporous* sp. 1, *Jelly* sp., *Schizophylum* commune, *Polyporous* sp. used for decolourisation and degradation of dye, on further screening of decolorizing seven mushroom cultures transferred over potato dextrose agar medium containing 0.01% malachite green (MG) dye. A plate assay was performed for the detection of decolorizing ability of mushroom clearing zone (decolorization) was formed surrounding the mushroom cultures. Decolorization was confirmed by UV-VIS spectrophotometer and studied at wavelength 540 nm. After 5 days percentage of dye degradation by *Jelly* sp. (98.25%), *Schizophyllum commune* (64.25%), *Polyporous* sp.2 (26.25%), and after 10 days the same species gives the percentage of dye degradation i.e. 99.75%, 97.5%, 68.5% respectively. But out of these three species Jelly sp. give the high percentage (after 5 days 98.25% and after 10 days 99.75%) of dye degradation.

Keywords: dye, decolorization, mushroom cultures, dergradation, malachite green, spectrophotometer, biodegradation

INTRODUCTION

A major class of synthetic dyes includes the azo, anthroquinone and triphenylmethane dyes. Dyes are difficult to degrade biologically, so that degradation of dyes has received considerable attention. Synthetic dyes are used extensively for textile dyeing, paper printing, leather dyeing, colour photography and as additives in petroleum products. Pollution from the effluents has become increasingly alarming with the usage of a wide variety of dyes in industries (GonCalves et al., 2000).

The textile dyes are highly reactive and during processing it is difficult to treat, themost commonly used are azo dye. About 100,000 commercially available dyes are known and nearly 1 million tons of dyes are produced throughout the year, whereas, out of the total usage, 10% of dyes are released in environment as dyestuff waste. (Maguire, 1992)

It is estimated that between 10 - 20% of dyestuff being used in the dyeing process could be found in wastewater. Several of these dyes are very stable to light, temperature and microbial attack, making them recalcitrant compounds (Banat et al., 1996).

Physical and chemical methods used for removal of dyes, that is, adsorption, chemical transformation, incineration, photo catalysis or ozonation are effective but rather costly (DeMoraes et al., 2000). The biodegradation of dyes by mushroom offers an advantage over other processes because of their ability to completely mineralize various dyes to CO_2 and H_2O. In the environment there are many microorganisms which are abundant but there potential is not utilized completely.objective of this study is to screen out dye degrading mushroom isolates from Chhattisgarh so that by the applying of this technique we can reduce dye contaminants in industrial effluents and make our environment ecofriendly.

MATERIALS AND METHODS

Seven cultures collected from modern biotech lab are: *Pleurotus florida, Pleurotus sajorkaju, Grifola frondosa, Polyporous sp.* 1*, Jelly sp., Schizophylum commune, Polyporous sp.* 2. All mushroom cultures were maintained on potato dextrose agar plates.

Screening for dye degradation

Screening test for dye degradation was carried out by the method of Machado et.al, 2005 by the using of potato dextrose agar (Hi Media) with malachite dye (MG) at 0.01%. Point inoculation was performed on dye rich medium and incubated at 28°C in BOD (Thermotech). Results were observed after 5 days and 10 days, clear zone was appeared against blue background.

Quantitative estimation for dye degradation

Estimation procedure for dye degradation was carried out by the method of Machado et al. (2005). Potato Dextrose broth (peeled potato, 200g; dextrose, 20g; pH 5.6 with 0.01% malachite dye) was prepared. 50 ml broth was transferred in 100 ml Erlenmeyer flask under the aseptic condition. Three discs (6 mm) of each mushroom isolates were inoculated to all triplicate flasks and incubated at 28°C for. Samples were withdrawn after 5 days and 10 days to estimate the decolonization rate. Whatman filter paper no 1 was taken and placed it on a Buchner funnel. Poured the contents of the flask into the funnel and observed the colour of the filtrate by using a spectrophotometer (Labtronics) at 560 nm.

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RESULTS

Decolorization of MG dye in solid medium

Seven species *Pleurotus florida, Pleurotus sajorkaju, Grifola frondosa, Polyporous sp.*1, *Jelly sp., Schizophyllum commune, Polyporous sp.* 2 were analyzed regarding its ability to decolorize a dye on solid medium. Out of seven species only three species *Jelly sp., Schizophyllum commune, Polyporous sp.* 2 shows the dye degradation in 4-5 days of incubation at 27°C. (Table: 1; Fig.1).

Decolorization of MG dye in broth medium.

After 5 days percentage of dye degradation by *Jelly sp.* (98.25%), *Schizophyllum commune* (64.25%), *Polyporous sp.*2 (26.25%) (Table: 2) and after 10 days these species gives the percentage of dye degradation i.e. 99.75%, 97.5%, 68.5% (Table: 3; Fig 2). But out of these three species *Jelly sp.* give the high percentage (after 5 days 98.25% and after 10 days 99.75%) of dye degradation.

Table 1: Screening of mushroom sps. for malachite green dye degradation

S.No.	Name of species	Observations (clear zone)
1.	*Pleurotus florida*	-
2.	*Pleurotus sajorkaju*	-
3.	*Grifola frondosa*	-
4.	*Polyporous sp.* 1	-
5.	*Jelly sp.*	+
6.	*Schizophyllum commune*	+
7.	*Polyporous sp.* 2	+

(+) = observed , (-) = not observed

Table 2: Percentage degradation of malachite green by Mushroom sps. (in 5 day)

S.No.	Name of species	Remaining dye (%)	Percentage of dye degrade (%)
1.	*Jelly sp.*	1.75%	98.25%
2.	*Schizophyllum commune*	35.75%	64.25%
3.	*Polyporous sp.* 2	73.75%	26.25%

Table 3: Percentage degradation of malachite green by Mushroom sps. (in 10 day)

S.No.	Name of species	Remaining dye (%)	Percentage of dye degrade (%)
1.	*Jelly sp.*	0.75	99.75%
2.	*Schizophyllum commune*	2.5%	97.5%
3.	*Polyporous sp.2*	31.5%	68.5%

DISCUSSION AND CONCLUSION

Seven species of mushroom isolated were *Pleurotus florida, Pleurotus sajorkaju, Grifola frondosa, Polyporous sp.*1, *Jelly sp., Schizophylum commune, Polyporous sp.*2. In our present work, all seven species were screened for malachite green dye degradation. Out of seven species only three species *Jelly sp., Schizophyllum commune, Polyporous sp.* 2 were showing best results for malachite green dye degradation. During incubation period after 5 days percentage of dye degradation recorded by each species were *Jelly sp.* 98%, *Schizophyllum commune* 64.25%, *Polyporous sp.*2 26.25% and after 10 days degradation recorded by each species were 99.75%, 97.5%, 68.5% respectively (Fig 3). Similar result was also obtained from *Fusarium solani*, originally isolated from the dye containing effluents could decolorize and degrade high concentration of crystal violet (CV) and malachite green (MG). Maximum decolorization of CV (98%) and MG (96%) could be achieved after 2 days of shaken incubation in the nutrient medium containing 2.5 mg dye/L (Abedin, 2008). However, in this part of work we study the dye decolorization or degradation and the possible fate of the utilized biomass in order to ensure the development of an eco-friendly technology.

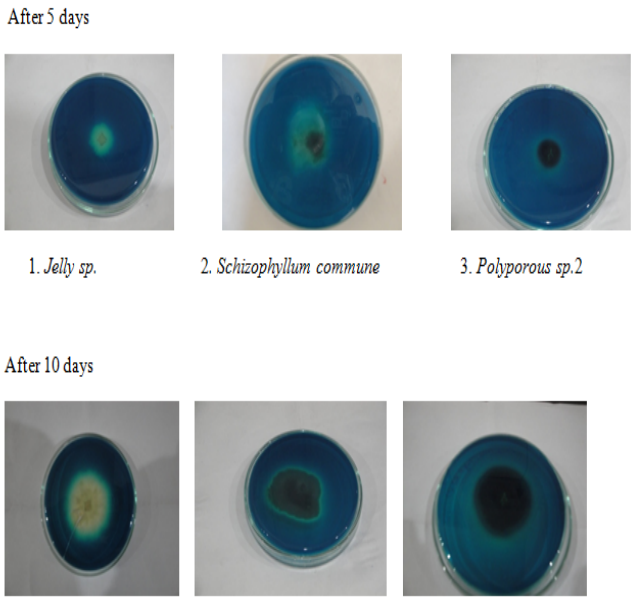
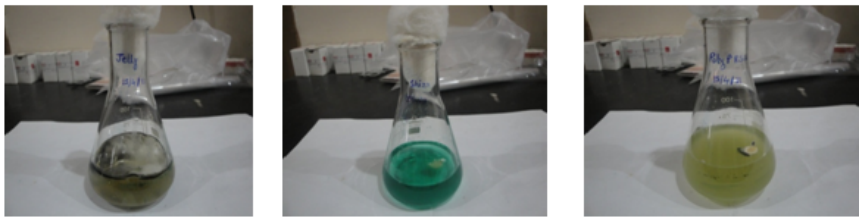


Fig 1: Screening of Mushroom sp. for Malachite Green dye degradation

After 5 days:



1. *Jelly sp.* 2. *Schizophyllum commune* 3. *Polyporous sp.2*

After 10 days

1. *Jelly sp.* 2. *Schizophyllum commune* 3. *Polyporous sp.2*

Fig. 2: Percentage degradation of Malachite Green by Mushroom Sp.

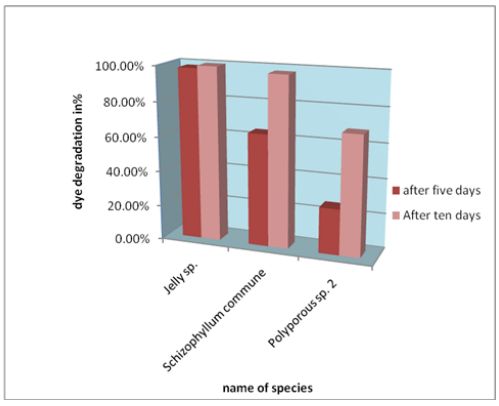


Fig 3: Comparative dye degradation of Mushroom isolates for malachite green dye

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