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Degradation of Textile Dyes by using *Aspergillus* Sp.

Hemalatha. V, Kalyani. P, Chandana Vineela. K, and Hemalatha. K.P.J*

Department of Microbiology, Andhra University, Visakhapatnam, A.P. India

*Corresponding Author E-mail: hemalathavinjarapu@gmail.com

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ABSTRACT

Fungi have the ability to degrade a diverse range of pollutants and are attracting wide-spread use in bioremediation. Successful application of decolorization of textile dyes to treat high concentration of industrial effluents will be a mile stone owing to advanced treatment processes. The decolorization of such harmful products is the major field of interest in research. In this investigation, the most common fungi, Aspergillus sp., is used for the decolorization of the dye. The fungus is inoculated PDA and optimized PDA containing the dye. In modified PDA the dye decolorization of dye is visualized after 5 days. The enhanced decolorization by Aspergillus sp. was attributed to the highest percentage of decolorization of 75% for five days.

Key words: *Congo Red, Malchite green, Brilliant green, Bromophenol blue, Aspergillus sp., Decolorization*

INTRODUCTION

Dyes are colored substance that are used in several substrates such a paper, fabrics, cosmetics etc.They are potentially capable of retaining in the substrates by means of physical absorption and also by making covalent bonding with the metals and salts. Dyes are majorly used in textile and in the printing industries. The paper and textiles are washed for removing the excess of dye present in the material and the water is ultimately released into the water bodies which turns out to be hazardous to the water–thriving creatures thus leading to their to extinction. This has become a major environmental pollution. It has been estimated that about 25% dyes from these industries are being released and this affects the processing of water for drinking purposes Dyes are synthetic and aromatic molecular structural compounds. They are used as substrates in food, cosmetics, paper, plastic and textile industries[1]. Among these various industries, textile ranks first in usage of dyes for coloration of fabric. During the dyeing process, approximately 10–15% of the dyes used are released into the aquatic environment like rivers and streams. The presences of these dyes in the aquatic ecosystem are the serious cause of environmental and health concerns[2,3]. In the modern era, the usage of the synthetic dyes increased rapidly for coloring materials because they are easy to prepare and give long standing appearance and quality to the materials on which they are used[4].

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In India, for the annual production of approximately 30 million tonnes of textiles, 70000 tonnes of dyes are required[5]. These dyes were discharged into the environment after processing causes serious environmental problems. The strong color of discharged dyes even at very small concentrations has a huge impact on the aquatic environment caused by its turbidity and high pollution strength[6]. Removal of dyes from textile effluents has been carried out by physical and chemical methods, such as flocculation, membrane filtration, electrochemical techniques, ozonation, coagulation and adsorption[7]. These methods are effective but they are expensive and involve the formation of a concentrated sludge that creates a secondary disposal problem. Considering drawbacks in above mentioned conventional treatment methods, microbial remediation techniques have gained much attention in the last few decades. A wide variety of microorganisms capable of decolorizing various dyes including bacteria, fungi were screened. The fungi were found to be dominant among them, since they were easy to manipulate and versatile in nature[8,9]. This study aims at investigating the potential of isolated fungal cultures for the decolonization of model textile dyes, congored and malachite green.

MATERIALS AND METHODS

Isolation, screening and identification of dye degrading fungi:

Marine soil samples were collected from Bay of Bengal, Kakinada. The sample were mixed in sterile water and serially diluted from 10^{-1} to 10^{-6} and 0.1 ml of diluted samples spread on Potato dextrose agar (PDA) plates separately. Plates were incubated at 25^0C for 5 to 7 days till the appearance of fungal colonies. The colonies were further streaked on the respective agar medium to get pure culture and observed under the light microscope for the identification of fungal isolate. All isolates were preserved on PDA slant in refrigerator.

Screening of decolorizing fungi

Screening of fungal strain from the marine soil samples were carried out to their ability to degrade the textile dyes by absorbance method. Fungal disc of 5 mm diameter cut from the 5 to7 days old culture was placed in flask containing 50 ml mixed textile Congo red and Malchite green. After 5 to 7 days, effective decolorization was seen visually.

Decolorization assay

Decolorization activity in terms of percentage of decolorization was determined by following method described by Moorthi *et al*.. 10 ml of sample was centrifuged at 2000 rpm for 4 minutes. The decrease in absorbance was monitored at 486nm for Orange 3R. Decolorization activity was calculated according to the following formula (Moorthi et al.,).

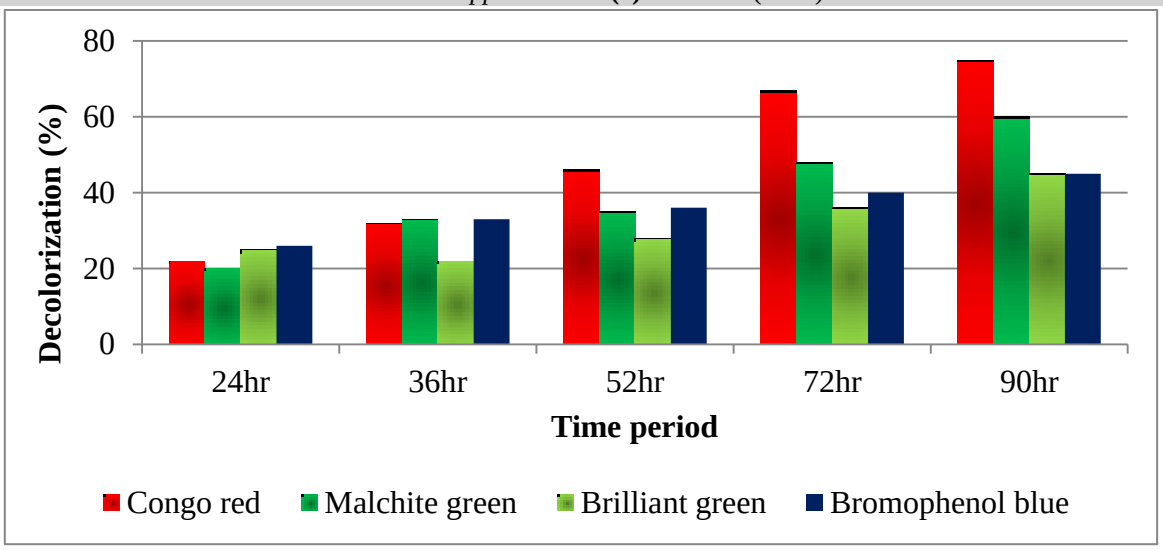
D= [AO-AI/AO] x 100

Where, D- decolorization; Ao- initial absorbance; AI- final absorbance.

RESULTS

Screening of Dye Decolorization:

In PDB broth the fungal isolate showed maximum decolorization. Congo red showed 75% decolorization, Malchite green showed 60% decolorization, Brilliant green showed 45% decolorization and methyline blue showed 45% decolorization. When compared to these four dyes Congo red showed maximum decolorization by fungal isolate after 5 days of incubation and methyline blue showed minimum decolorization by *Aspergillus sp.* after 5days of incubation.



DISCUSSION

The present study was performed to examine the microbial degradation of hazardous dye in semi-solid medium, taking a fungus, *Aspergillus sp.* as the experimental organism and a textile dyes, Congo red, Malchite green, Brilliant green, Bromophenol blue as the testing dyes. The fungal isolate has shown positive results for dyes degradation, as was indicatedby the change and disappearance of colour of the dyes from the dye-containing media of the flasks. Our result was 80% of Congo red dye and 59% of Malchite green dye was to best biodegradation by Aspergillus sps., Cripps and Bumpus also reported the biodegradation of three azo dyes (Congo red, Orange II and Tropaeolin 0) by the fungus *Phaenerocheate chrysosporium.* In our study biodegradation of dye was also observed based on the change of colour. The process of degradation of these types of harmful dyes is now-a-days done by employing fungi are also carried out to reduce their ill effects. The degradation is supplying a single fungal organism and the experiment is carried out by using the testing dye that promisingly showed positive results. The organism showed the initiation of decolorization process by gradual color change and is predominant after 5days. The fungal strain used in the present study was responsible for biodegradation/decolourization of textile dyes, and it was also responsible for change in dye colour in the medium with dye containing flasks.

CONCLUSION

The study clearly indicates the role of selected fungal isolates of *Aspergillus sp.* for achieving enhanced decolorization/degradation of dyes. This study suggests that the isolated fungal strains belong to *Aspergillus* sp. And possess a significant dye degradation capacity and can be applied in bioremediation of toxic industrial dyes in near future. Fungi have considerable attention due to their extracellular enzymes involved in the diverse applications. Biosorption of dyes by fungi is an effective method, cost-efficient and eco-friendly. The regenerated biomass can be recycled for bioremediation of textile effluents.

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