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DECOLOURIZATION OF DYE CONGO RED BY *RHIZOPUS ORYZAE* SILVER NANOPARTICLES

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Abstract : Bioremediation using a variety of microbes for the xenobiotics degradation seems a green solution to the problem of environmental pollution. Microbes have been gifted by nature with the ability of degrading a wide spectrum of environmental pollutants. Different fungi have the potentials to degrade complex and recalcitrant organic compounds into simpler fragments; sometimes achieving complete mineralization. Nanomaterials reveal good result than other techniques used in waste water treatment because of its high surface area. It is suggested that these may be used in future at large scale water purification. In the present study we have reported the decolorization of the dye congored by using Rhizopus oryzae silver nanoparticle and its comparison with plain culture. In the present study, synthesised nanoparticles were checked for their efficiency to decolorize the dye congored. The nanoparticle efficiently decolorized the dye within 48 hours of incubation where as the plain culture (Control) partial decolorization continued upto 78 hours. In our experiment, we found that Rhizopus oryzae silver nanoparticle as an efficient decolorizer against the dye congored.

***IndexTerms - Rhizopus oryzae*, silver nanoparticles, decolorization of the dye congored**

I. INTRODUCTION

Nanotechnology is an active area of research with tremendous applications for society, industry and medicine. The non-polluting nanotechnologies have revolutionized the production of nanomaterials as environmentally safe products. Environmental pollution from human activities is a major challenge of civilization today [1-3]. Textile dyes constitute a major source of pollution. Textile industries consume a major share of dyes in India [4]. Textile dyes are classified as azo, diazo, cationic, basic, anthraquinone base and metal complex dyes based on the nature of their chemical structure. Synthetic dyes such as azo dyes, xanthenes dyes and anthraquinone dyes are very toxic to living organisms. Azo dyes constitute a major class of environmental pollutants. Some of the azo dyes or their breakdown products are known to be highly toxic and mutagenic on living organisms [5]. Characteristics of the waste water from textile industries vary depending on the process employed [6]. Accordingly wastewater generated from of the operations in wet processing such as desiring, scouring, bleaching, mercerizing, dyeing, printing and finishing differ considerably [7&8]. Removal of dyes from textile waste effluents has been carried out by physical, chemical and biological methods, such as flocculation, membrane filtration, electrochemical techniques, ozonation, coagulation, adsorption and fungal discoloration [9]. Fungal bioremediation is becoming an attractive option for removal of dyes from industrial effluents as microorganisms are nature's tools for cleaning the environment. Dyes may significantly affect photosynthetic activity in aquatic life because of reduced light penetration and may also be toxic to some aquatic life due to the presence of aromatics, metals, chlorides, etc. [10]. Nanotechnology enables the development of nanoscale particles of metals with novel and distinctive physic-chemical properties, and a broad range of scientific and technological applications [11]. Another potential use of silver nanoparticles in water filters in wastewater treatment plants. At nanoscale silver exhibits remarkably unusual physical, chemical and biological properties [12&13]. Recently it was shown that silver ions may be reduced extracellularly using fungus Phanerochaete chrysoporium [14] and Pleurotus sajorcaju [15]. In this paper, we have made an attempt to decolorize the dye congored by silver nanoparticle synthesized by using Rhizopus oryzae and its comparison with its plain culture.

II. RESEARCH METHODOLOGY

2.1 Synthesis and Characterization of silver nanoparticles

Rhizopus oryzae were isolated from the soil samples namely, soil dilution and direct isolation techniques. The filtrate was treated with 1mm AgNO3 solution in an Erlenmeyer flask and incubated at room temperature in dark. The formation of silver nanoparticles was preliminary confirmed by the colour changes and further they were characterized by UV-Visible Spectroscopy analysis and FTIR-Spectroscopy [16].

2.2 Decolourization studies

For decolourization study, 250 mL Erlenmeyer flasks containing 125 mL solutions of congo red was prepared in the media containing sucrose, NaNO3, KCl, MgSO4.7H2O, FeSO4.7H2O, K2HPO4 and agar per ml was used. Final pH of the medium is 7.3 ± 0.2. The *Rhizopus oryzae* silver nanoparticle was added to the above media which is indicated as test. Similarly plain culture (*Rhizopus oryzae*) was also added to this media separately which serves as control for the above. Congo red of 50µM concentration was used in this study. The flasks were incubated at room temperature. After 24hr interval samples were withdrawn, filtered and centrifuged at 4400rpm for 5mins and the supernatants was analyzed spectrophotometrically using UV-Visible spectrophotometer at 498nm.

III. RESULTS AND DISCUSSION

3.1 Decolourization studies

A significant decolorization rate was observed for the dye Congo red. The *Rhizopus oryzae* silver nanoparticle effectively decolourized 80.02% of dye within 42 hour incubation and the dye was fully decolourized within 78 hour of incubation. Whereas the plain culture (*Rhizopus oryzae*) was able to degrade only 40% of dye at the same incubation conditions and partial decolourization was observed after 78 hour incubation (Fig.1)

The present study revealed the ability of the *Rhizopus oryzae* silver nanoparticle to decolourize Congo red, nanoparticles decolourize better than the plain culture of the same strain. The development of such particles may be considered a breakthrough in the field for the efficient clean up of the dyes. They are easy to synthesize and cost effective.

(Fig.1) Degradation of dye after 72 hours of incubation after addition of silver nitrate

IV. ACKNOWLEDGMENT

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