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DECOLOURIZATION OF INDUSTRIAL DYE BY *RHIZOPUS ORYZAE* SILVER NANOPARTICLES

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Abstract : Microorganisms play an important role in toxic remediation of metals through reduction of metal ions. In this paper, we have reported the decolorization of the industrial dye by silver nanoparticle synthesized by using *Rhizopus oryzae* and its comparison with its plain culture(*Rhizopus oryzae*).The characterization of silver nanoparticle was done by using UV-visible spectroscopy and FTIR. These silver nanoparticles were then checked for their efficiency to decolorize the industrial dye. The *Rhizopus oryzae* silver nanoparticle effectively decolorized the dye within 24hours of incubation when compared with its plain culture (*Rhizopus oryzae)* which takes more than 48 hours for the same process. This is for the first time reporting that *Rhizopus oryzae* silver nanoparticle was used for the decolorization of the industrial dye.

***IndexTerms - Rhizopus oryzae*, silver nanoparticles, decolourization of the industrial dye.**

I. INTRODUCTION

Nanotechnology is the science and technology of small things i.e. 'nano'. This term originate from Greek word meaning 'dwarf'. This term was firstly used by 'Richard Feynman' in 1959. Therefore nanotechnology term was used from last 53 years. Microbes play an important role in nanotechnology due to the synthesis of nanoparticles by biological method. Microbes are the microscopic organisms which are single or multicellular found in all universes. They include the bacteria, algae, fungi and protozoa. Textile dyes constitute a major source of pollution. Textile industries consume a major share of dyes in India [1]. 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 [2]. Characteristics of the waste water from textile industries vary depending on the process employed [3]. Accordingly wastewater generated from of the operations in wet processing such as desiring, scouring, bleaching, mercerizing, dyeing, printing and finishing differ considerably [4&5]. 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 [6]. 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. [7]. Recently it was shown that silver ions may be reduced extracellularly using fungus *Phanerochaete chrysoporium* [8] and *Pleurotus sajorcaju* [9]. In this paper, we have made an attempt to decolorize the industrial dye 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 [10].

2.2 Decolourization studies

For decolourization study, 250 mL Erlenmeyer flasks containing 125 mL solutions of industrial dye 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

at 25ºC[11]. 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. industrial dye 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. The decolorization efficiency was expressed as per the following equation; Decolorization (%) = [(Initial Absorbance – Final Absorbance) / Initial Absorbance] × 100.

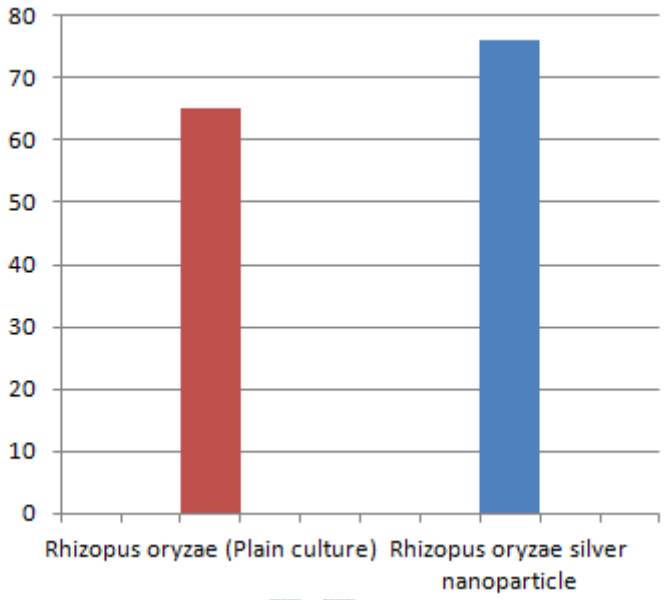
III. RESULTS AND DISCUSSION

3.1 Decolourization studies

A significant decolorization rate was observed for the industrial dye. The *Rhizopus oryzae* silver nanoparticle effectively decolourized 76% of dye within 24 hour incubation and the dye was fully decolourized within 35 hour of incubation. Whereas the plain culture (*Rhizopus oryzae*) was able to degrade only 65% of dye at the same incubation conditions and complete decolourization was observed after 48 hour incubation (Fig. 1). Decolourization of malachite green by *Acremonium kiliense* have been reported in earlier studies [12]. According to them 95.4% MG was decolorized within 72 hours. In this study, when compared with nanoparticle the plain culture could degrade only 65% of the dye this might me due to the complex nature of the dye. A slower rate of decolourization was attributed to higher molecular weight, structural complexicity of the dyes [13].

The present study revealed the ability of the *Rhizopus oryzae* silver nanoparticle to decolourize industrial dye, 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 24 hour of incubation



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