



Adsorption Of Dyes By Thermophilic Fungus *Rhizomucor Pusillus*

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Abstract: Beautiful colours of cloths are always preferred by today's generation. Textile industries are using synthetic dyes to prepare different coloured materials and these dyes are prepared from various compounds having carbon and nitrogen bonding such as $-C=C$, $-N=N-$ and $-C=N-$. The azo dyes constitute largest group among them. After the use of these dyes in the industries, about 30-40% of dye content goes in effluent thus making waterbodies polluted. The treatment of dye effluents by various methods have been studied by many workers from time to time such as physico-chemical methods, adsorption, flocculation, ion exchange membrane filtration, reverse osmosis, these methods are not efficient because of their high cost which are not affordable, thereby keeping the effluents untreated most of the times. The microbes are efficient in decolorizing/ degradation of these dye effluents as compared with other methods, because of their cost effectiveness and environment friendliness. The thermophilic fungi are known to survive at high temperature environments there by producing the thermostable enzymes to withstand in elevated temperatures. Further, a variety of thermophilic microbial strains have been demonstrated to be useful in degrading dyes catalyzed by various thermostable enzymes. In the present study attempts were made to assess the ability of thermophilic fungus *Rhizomucor pusillus* to adsorb the dyes. Two dyes, viz. Methyl violet and Basic fuchsin were selected. Maximum dye adsorption was observed in lower concentrations of dyes i.e. 1-5 ppm and at higher concentrations the adsorption was reported to be lesser. Fungi offer a promising solution for the treatment of dye-contaminated wastewater. Their ability to efficiently adsorb dyes, coupled with their sustainability and cost-effectiveness, makes them a valuable tool in environmental remediation efforts. Textile industrial effluents containing dyes is matter of great attention now a days as this activity adds more and more dyes in water bodies.

Index Terms - Methyl violet, Basic fuchsin, adsorption, thermophilic fungus, *Rhizomucor pusillus*.

I. INTRODUCTION

The textile industries are trying to improve the colours of cloths days by day. These industries employ several synthetic dyes to create different coloured materials. These dyes are composed of various of organic compounds such as $-C=C$, $-N=N-$ and $-C=N-$ responsible for giving colours. When this bonding is broken, the dyes lose their colours. The Azo dyes have largest group among them. These dyes are not degraded in the environment naturally. The textile mills use these dyes in abundant quantities for dyeing of cloths. However, a large amount of dye nearly 30-40% gets up in the effluent. Hence, the launching of textiles Industry effluent with high quantities of the dyes have the potential to pollute the environment significantly and polluted water affect the environment by disturbing the life of aquatic biota. To lower the dye's environmental impact, biological treatment of textile industrial wastewater is considered as vital (Aragaw *et. al.*, 2022).

The treatment of dye effluents by various methods have been studied by many workers from time to time such as physicochemical methods, adsorption, flocculation, ion exchange membrane filtration, reverse osmosis, these methods are not efficient because of their high cost which are not affordable, thereby keeping the effluents untreated most of the times (Ogugbue *et. al.*, 2011).

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thermophilic fungi are known to survive at high temperature environments there by producing the thermostable enzymes to withstand in elevated temperatures. Furthermore, a variety of thermophilic microbial stains have been demonstrated to be useful in degrading dye catalyzed by various thermostable enzymes. This demonstrates the significant potential of thermophiles for use in the treatment of dye containing in the textile sector (Zille 2005). But only sporadic references could be gathered about the degradation of such dyes by thermophilic microorganisms. Therefore, present study deals with the attempt of degradation of dyes with the help of thermophilic microorganism.

II. Materials and Methods:

In the present study attempts were made to assess the ability of thermophilic fungus *Rhizomucor pusillus* to absorb the dyes. Two dyes, viz. Methyl violet and Basic fuchsin were selected for the present study.

Rhizomucor pusillus was cultivated on Glucose asparagine liquid medium and after 7 days of growth mycelium was harvested by filtering through Whatman no 1 filter paper. Mycelium was washed thrice with distilled water. Excess water was blotted out and mycelium was dried in oven at 80°C overnight.

The dye absorption was studied by adding 0.5g of dried mycelium in 50ml of dye solution (1, 5, 10 and 20 ppm) in a conical flask of 150ml capacity. The mycelium along with dye solution was left over rotary shaker. Centrifuged the content at 4000rpm. Unadsorbed dye concentration was estimated in supernatant by spectrophotometer using standard curve of dye solution. For methyl violet λ_{max} was 585nm, Basic fuchsin λ_{max} was 550 and for mixture of both the dyes it was also 550nm. All the treatments were carried out in triplicates.

III. Result and Discussion:

Adsorption of dyes by dead fungal mycelium was attempted in present investigation by using *Rhizomucor pusillus* mycelium. Two dyes, namely basic fuchsin and methyl violet were used. The concentration of both dyes was kept constant viz., 1, 5, 10, 15, ppm and the observations are as follows-

Maximum dye adsorption was observed in lower concentrations of dyes i.e. 1-5 ppm and at higher concentrations the adsorption was reported to be lesser. Relatively, both the dyes adsorbed almost similar concentration. In 1 ppm concentration of basic fuchsin about 98% dye was adsorbed and at 20 ppm 73.73% dye adsorption was observed. On the other hand for methyl violet in 1 ppm concentration 97.60% and for 20ppm 77.29% dye was adsorbed which is quite higher than the adsorption of basic fuchsin (Table 1) Li *et. Al.*, (2019) has reported efficient dye decolouration ability (90%) by *Aspergillus niger*. Similarly In tube overlay method, highest decolorization was reported in Malachite green and Nigrocin (92.85 and 93.33% respectively), followed by Basic fuchsin (90.05%) by *A. niger*. (Rani *et. at.*, 2014).

Table 1: Dye Adsorption by *Rhizomucor pusillus*.

| Dye Conc. (ppm) | Adsorption | | | |
|--------------------|---------------|-------|---------------|-------|
| | Basic Fuchsin | | Methyl Violet | |
| | ppm | % | ppm | % |
| 1 | 0.98 | 98.00 | 0.976 | 97.60 |
| 5 | 4.331 | 86.62 | 4.880 | 97.60 |
| 10 | 7.569 | 75.69 | 8.286 | 82.86 |
| 20 | 14.746 | 73.73 | 15.458 | 77.29 |

Conc.- Concentration, ppm- part per million, %- percentage,

Saranraj *et. al.*, (2010) also reported the degradation of dyes by seven different mesophilic fungi against 6 dyes.

IV. Conclusion:

Fungi offer a promising solution for the treatment of dye-contaminated wastewater. Their ability to efficiently adsorb dyes, coupled with their sustainability and cost-effectiveness, makes them a valuable tool in environmental remediation efforts. Textile industrial effluents containing dyes is matter of great attention now a days as this activity adds more and more dyes in water bodies. From the present study it is concluded that, thermophilic fungi possess ability of dye adsorption/degradation of harmful dyes. Further research and optimization of fungal biosorption processes can contribute to developing even more efficient and environmentally friendly technologies for dye removal.

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