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Biosorption of waste water azo dye by dead fungal biomass of *Rhizopus nigricans*

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Abstract

Pollution has emerged as one of our most serious concerns. Untreated or partially treated waste fluids and industrial effluents released into natural habitats constitute a significant hazard to the ecosystem and diverse forms of life. Color is the most difficult of the organics present to remove. Dye in these firms' effluents is highly complex, frequently non-biodegradable, and dangerous to both aquatic and non-aquatic biota. Using dead cells for biosorption has several advantages over using living cells. As a result, there is currently a demand for research into biosorption waste methods. *Rhizopus nigricans* isolates from our lab were tested as bio sorbents. Potato Dextrose Agar medium and yeast maltose Sucrose liquid media (YMS) were employed to grow fungi. During the experiment, the dye concentration in the effluent was treated with fungal biomass. Following the results of the experiments, we discovered that Rhizopus nigricans was a considerably more efficient biosorption agent in general.

Key words : Pollution, Azo Dye, Biosorption and *Rhizopus Nigricans.*

Pollution has become one of our most pressing worries. The release of untreated or partially treated waste fluids and industrial effluents into natural habitats poses a major threat to the ecosystem and various forms of life. Color is the most difficult to remove of the various organics present. Synthetic dyes such as azo, anthraquinone, polycyclic, and triphenylmethane are increasingly being employed in textile dyeing and printing processes. Dye included in effluents generated by these companies is quite complex, frequently non-biodegradable, and hazardous to both aquatic and non-aquatic biota. Biosorption techniques have been successfully applied in the wastewater treatment process, mostly for heavy metals[1-4,6] Biosorption is defined as "a technique in which natural solids are used for the sequestration, separation, and isolation of heavy metals from an aqueous environment"[5].

The use of dead cells for biosorption has numerous advantages over the use of living cells. As a result, there is a current need to conduct research on biosorption waste procedures.

One solution could be to use biosorption-based technology. Because Rhizopus nigricans was previously discovered to be an excellent biosorption of basic fuchsin in our laboratory[7], it was decided to investigate whether the dead biomass of these fungus might be used for biosorption of azo dyes from effluents.

Fungal Biomass preparation :

Rhizopus nigricans isolates from our lab were tested as biosorbents. On Potato Dextrose Agar medium, the fungal culture was kept alive (PDA). Each fungus' spore suspension was injected in 2000 ml of Yeast extract Malt extract Sucrose liquid media (YMS). This 2000 ml of (YMS) medium was distributed equally among 16 250 ml flasks. For fungus, 16 flasks holding 125 ml of media were utilised. Following inoculation, the flasks were shaken for 48-72 hours (28-300C), and then for around 25-30 days with occasional shaking. Fungal growth (Pellets) were strained through a plastic sieve, wet biomass rinsed three times with tap water, then autoclaved at 15 psi for 20 minutes in the final wash water. The water was drained, and the wet biomass was dried for 5 days at 37-400°C. The dried fungal biomass was crushed using a mortar and pestle, and the powdered biomass was sieved using a basic sieve. The powered samples were kept in a dry place until they were needed again.

Production of effluents and dye :

The wastewater containing azo dye from a textile dyeing factory near Ghaziabad was collected. The azo dye powder used by the unit was also available on the market.

Curve preparation for standard calibration:

Because the industrial unit dissolves 5 Kg of azo dye in 800 litres of water, a dye solution of equivalent concentration was generated by dissolving 6.25 gramme of the dye in 1 litre of water to prepare stock solution. Because the solution's optical density was outside the range of the spectrophotometer, a dilution was created. 1ml of the dye solution was properly mixed with 99 ml of distilled water for this. The maximum absorption wavelength of the solution was discovered to be 485 nm. Different dye concentrations were created from the stock solution by mixing 10ml, 20ml, 30ml, 40ml, 50ml, 60ml, 70ml, 80ml, and 90ml of the dye solution with enough water to make 100 ml of each solution. The O.D. of these solutions was measured and plotted on graph paper to determine the best match line. This standard graph was used to determine the concentration of dye in various solutions, such as untreated effluents and effluents treated with various types of fungal biomass.

Estimation of dye content in untreated effluents :

1 ml of sewage was mixed with 49 ml of water to make a total volume of 50 ml, and the effluent was diluted 50 times. The O.D. was measured and determined to be 0.415. When multiplied by the factor 4243.98, the result was 0.415 4243.98 = 1761.25, indicating that the concentration of dye in the effluent was 1761.25 ppm.

Dye concentration in effluent treated with fungal biomass estimation :

A total of 54 flasks were filled with 50 cc of diluted effluent as specified in section

3.4. The set was partitioned into six flask subsets, with each flask receiving 100 mg of *Rhizopus nigricans* biomass. The flasks were shaken mechanically. At regular intervals (5 min, 10 min, 15 min, 20 min, 25 min and 30 min). Three flaks from the subset were removed and their contents decanted before 10 ml fractions were centrifuged at 4000 rpm for 10 minutes. The optical density of the supernatant fluids was measured at 485 nm. The dye concentration in the supernatant was determined using the same factor described previously. The percentage reduction in dye quantity as a result of the biomass treatment was estimated. The biosorbent's dye absorption was determined using the formula-

$$Q = V (Ci-Ct)/m$$

Where Q is the dye uptake (mg dye per g bio sorbent), V = the liquid sample volume (ml), Ci = The initial concentration of the dye in the solution (mg/l), Ct = the final (equilibrium) concentration of the dye in the solution (mg/l) and M = the amount of added bio sorbent on the dry basis (mg).

Dye Bisorption By Fungal Biomass - The potential of dry *Rhizopus nigricans* biomass to adsorb red dye (Brodex) was investigated. The dry powder of fungal species was allowed to biosorb dyes for 5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes, and 30 minutes. Biomass concentrations of 100mg, 150 mg, and 200 mg were tested. The acquired results are shown in the table-1.

The percentage of dye uptake and the concentration of azo dye remaining in the effluent following treatment with varied concentrations of dry powder *Rhizopus nigricans* biomass following various contact times. (The initial concentration in the effluent =1761.25ppm.).

Table-1. Dye uptake by *Rhizopus nigricans*

Contact Time	Amount of Fungal biomass		
	100mg biomass	150 mg biomass	200 mg biomass
5min	568.69 ± 0.104 **67.71%**	522.00 ± 0.203 **70.36%**	551.71 ± 2.733 **68.67%**
10 min	700.25 ± 0.0895 **60.24%**	496.54 ± 0.823 **71.80%**	530.49 ± 0.121 **69.87%**
15 min	551.71 ± 0.0348 **68.67%**	318.29 ± 0.0848 **1.92%**	445.61 ± 0.1177 **4.69%**
20 min	471.08 ± 0.0257 **73.01%**	424.39 ± 0.016 **77.90%**	763.91 ± 0.033 **56.62%**
25 min	475.32 ± 0.012 **73.01%**	662.06 ± 0.751 **62.42%**	110.99 ± 1.358 **93.69%**
30 min	585.66 ± 0.163 **66.74%**	870.01 ± 0.016 **50.60%**	819.08 ± 0.144 **53.49%**

A quick check at the tables reveals that

(a) Biomass was quite successful for azo dye biosorption. 150 mg biomass removed up to 66.50% of the dye from the wastewater.

(b) *Rhizopus nigricans* was a far more efficient biosorption agent in general.

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