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Decolorization of Azo Dye by Different Microbial Strains

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Abstract: ***In the present study an attempt was made to examine the potential of different bacterial strains for decolorization of Malachite Green with different concentration.. Samples were collected from different polluted sites. Strains were isolated from different experiments using dye with Different concentration. The ability of isolated bacterial strains to degrade the Malachite Green is more than 60%. Few strains show 80% decolorization of Malachite Green dye.***

Keywords: Azo dye, malachite green, bacterial strains , degradation, polluted sites

1. Introduction

Malachite Green (MG) is a triphenyl methane dye, which is most widely used for coloring purpose, amongst all other dyes of its category (Gupta V.K., 2004). MG has properties that make it difficult to remove from aqueous solutions. If the solution containing MG discharged into receiving streams it will affect the aquatic life and cause detrimental effects in liver, gill, kidney, intestine and gonads. In humans, it may cause irritation to the gastrointestinal tract upon ingestion. Contact of MG with skin causes irritation and redness and pain. Upon contact with eye will lead to permanent injury of human eyes and laboratory animals (Mathur, 2022).

Large amount of dye containing effluents are discharged into water bodies by these industries carrying pollution problem. This pollution problem is a topic of great public and government concern today, forced by legislation. The industrial units are now looking forward to cost effective solutions for reduction of pollution loads to meet the regulatory requirements. Microbial degradation seems to be promising compared to other organisms and the method of application are simpler compared to other available methods. (Jayaranjan.et.al, 2011) (Mathur and Vyas 2016). The discovery of activities of microorganisms in the breakdown of crude to less harmful products, give rise to "Bioremediation." This technology uses the microbes to accelerate the natural breakdown of dyes into less harmful products.

This study aims to investigate the potential of bacterial cultures for decolorization effluent containing a textile dye. Malachite Green decolorization by bacterial cultures with respect to various concentrations.

2. Material and Methods

Samples were collected from the different areas of Western Rajasthan. Total 13 samples were collected in screw capped sterile bottles from textile industries.

The dye used in this study was of industrial grade and purchased from local market of Jodhpur, Rajasthan India. All the other chemicals used were of analytical grade.

Isolation of strains:

All the isolates were isolated from serial dilution on nutrient agar plates. The isolated strains were grown on Minimal Medium for 24 hours at 37˚ C. Aliquots (10 ml) of suspension (10% w/v) were inoculated into 100 ml of dye containing Minimal Media (in 250 ml Erlenmeyer flask) and incubated at 30°C under static condition to screened out the strains having ability to degrade the dye.

Effect of dye concentration:

The various concentration of Malachite Green dye (10/20/30/40/50 mg/L) was used with the culture medium in order to examine the rate of dye degradation in static condition at 37˚C.

Rate of Decolorization:

Decolorization was quantitatively analyzed by measuring the absorbance of the supernatant with UV-Visible spectrophotometer at wavelength of 616nm. Decolorizing rate was calculated by using equation (Saratale et al., 2006).

Decolorization % = (A-B)/A * 100

A = initial absorbance i.e. initial dye concentration (mg/L)
B = final absorbance i.e. residual dye concentration (mg/L)

3. Results

Release of textile industry effluents in water bodies creates a major threat to the natural resources as well as human health and hygiene. Azo dyes are widely used in textile industries, and about 50% of the dye stuffs were released in effluent and discharge into nearby water bodies.

It has been reported that bacteria inhabits in industrial effluents utilizing its constituents as their source of energy.

Screening of bacterial isolates was performed to figure out the isolates capable of degrading Malachite Green dye in mineral salt medium with different concentration up to 50mg/L.

Notably 19 bacterial strains capable to degrade the majority of dye up to 60% were screened out of total isolates and considered as "Potential Candidate." The bacterial strains

exhibiting strong decolorizing activity were investigated further.

From sample 1, four strains were isolated S1A, S1B, S1C, and S1D. Out of which only S1D showed decolorization up to 75% at 20. 30.40 and 50 ppm. concentration. (Table: 1,).

Table 1: Decolorization of Malachite Green dye at different concentration by SAMPLE 1.

	10 ppm			20 ppm			30 ppm			40 ppm			50 ppm		
Sample	Initial OD	Final OD	% of removal	Initial OD	Final OD	% of removal	Initial OD	Final OD	% of removal	Initial OD	Final OD	% of removal	Initial OD	Final OD	% of removal
A	.2145	.1736	19.06	.2868	.1160	59.55	.3178	.0538	83.05	.6807	.5030	26.10	.9072	.2665	70.62
B	.2145	.1564	27.08	.2868	.1644	42.67	.3178	.1974	37.88	.6807	.1837	73.01	.9072	.8286	8.66
C	.2145	.1644	23.35	.2868	.1134	60.456	.3178	.2096	34.04	.6807	.1932	71.61	.9072	.2605	71.28
D	.2145	.1729	19.39	.2868	.0744	74.05	.3178	.0650	79.54	.6807	.1717	74.77	.9072	.2002	77.93

Similarly sample 2 gives total 8 strains out of which four strains i.e. A, B, F and G showed decolorization up to 75% at 50 ppm concentration (Table: 2,).

Table 2: Decolorization of Malachite Green dye at different concentration by SAMPLE 2

	10 ppm			20 ppm			30 ppm			40 ppm			50 ppm		
Sample	Initial OD	Final OD	% of removal	Initial OD	Final OD	% of removal	Initial OD	Final OD	% of removal	Initial OD	Final OD	% of removal	Initial OD	Final OD	% of removal
A	.2145	.1571	26.75	.2868	.1801	37.20	.3178	.2054	35.36	.6807	.6735	69.01	.9072	.2321	74.415
B	.2145	.1817	15.29	.2868	.1763	38.52	.3178	.3000	5.60	.6807	.3000	55.92	.9072	.3000	76.93
C	.2145	.0944	55.99	.2868	.2330	18.75	.3178	.3057	3.80	.6807	.5680	16.55	.9072	84.87	6.44
D	.2145	.1728	19.44	.2868	.2015	29.74	.3178	.2653	16.51	.6807	.4188	38.47	.9072	.7240	20.19
E	.2145	.1734	19.16	.2868	.1916	33.193	.3178	.1943	38.86	.6807	.6747	0.884	.9072	.9032	0.44
F	.2145	.069	67.5	.2868	.2354	17.921	.3178	.2536	26.17	.6807	.3000	55.92	.9072	.2344	74.16
G	.2145	.1780	17.01	.2868	.2549	11.122	.3178	.1959	38.35	.6807	.3136	53.92	.9072	.2112	76.71
H	.2145	.1893	11.74	.2868	.2586	9.83	.3178	.3113	2.045	.6807	.6384	6.21	.9072	.7292	19.62

It is difficult for microbes to utilize Azo dye as their nutrient as it is deficient carbon source. The present study revealed that maximum strains isolated having potentiality to decolorized the Malachite Green Dye having Azo compound up to 78% at specific concentration.

Few strains were not having ability to decolorized but at the same time atleast 40% strains from total isolates were show high efficiency of decolorization. These strains give 65-80 % positive result.

The bacterial isolates can be exploited for bioremediation of azo dye containing waste to degrade toxic reagents into less or non-toxic product form.

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