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Degradation of Malachite Green Dye by Soil Bacteria from Dumping Site, Boisar, Maharashtra, India

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ABSTRACT

Malachite green dye is extensively used in sectors of paper, textile, cosmetic and leather. The subsequent increase in demand for dyes has caused exploitation of the environment. Biodegradation of dyes by the means of microorganisms is widely in use due to their high effectiveness and productivity. In the present study, dye degrading organisms have been isolated from the dump yard at Boisar, Maharashtra on selective nutrient media consisting of Malachite green dye. It was observed that the organism was able to decolorize 4 ppm dye within 72 hours of incubation. By means of microscopic, cultural and biochemical tests for identification of bacterial cultures, the organism responsible was found to be *Citrobacter spp.* This approach makes a way to deal with the damaging effects of dyes on the ecosystem.

Key words: *Malachite green dye, Biodegradation, Decolorize, Citrobacter spp.*

Introduction

Malachite green is a triphenylmethane dye widely used in the textile industry. It has been reported as a highly toxic dye to humans causing cancer, nausea and skin irritation and also affecting the flora and fauna of the ecosystem in which it is discharged. These colored effluents when released into the environment have high chances that they may interfere with the organisms present in the habitat proceeding to harm the humans (Arunprasath *et al.,* 2019).

Therefore, there is a crucial need for finding a solution for detoxification of the hazardous effects of dyes on various life forms present in the environment. Numerous physical and chemical methods are used for treating the industrial wastewater effluents containing the Malachite green dye. In spite of that, bioremediation methods are marked the most efficient way to handle ecosystem problems as it leaves no toxic byproducts after it is detoxified by the dye degrading microbes and other living forms (Uma Shankar Prasad Uday, Bandyopadhyay Tarun Kanti, 2016).

The present study focuses on the bacterial degradation of the Malachite Green dye using the bacterial isolate, isolated from the dumping yards in Boisar, Maharashtra. As the dumping site in Boisar is dumped with the textile and other xenobiotic waste it serves as a source of the dye degrading bacteria.

Materials and Method

Sample collection

Soil sample was collected from the dumping site of Boisar area in Palghar, Maharashtra. The superficial soil was removed and a pit of 4 cm was dug for col-

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lecting the soil sample.

Dye preparation

20 ppm of Malachite green dye was used as a stock solution. Out of which 4 ppm, 8 ppm and 12 ppm concentrations of the dyes were prepared in distilled water.

Screening and identification of Soil Microorganisms

The soil sample collected was serially diluted in Sterile Normal saline and the last three dilutions, i.e. 10^7, 10^8 and 10^9 were spread on a plate of nutrient agar . Further on obtaining the colonies on Nutrient agar, the colonies were transferred in the nutrient agar containing the mentioned concentrations of the Malachite green and incubated at 25+/-2 ^oC until decolourization was observed. Colonies showing the zone of decolourization were selected and were identified by microscopic, cultural and biochemical identification methods for bacterial cultures.

Decolourization Assay

Dye degradation was obtained by inoculating the isolated bacterial cultures in Sterile nutrient broth containing 4 ppm of the dye, incubated at 25^o C, pH 6.8 till the dye was decolourized and was determined by visible spectrophotometer at 620nm.

Results

Screening and identification of Soil Microorganisms

The isolated colonies were then streaked on selective nutrient agar plate containing malachite green dye.

Identification

On gram staining of the colony, the organisms observed under 100X were Gram negative rods.

Cultural characteristics

On Nutrient media

On Selective media containing Nutrient agar and 4 ppm, 8 ppm, 12 ppm of the Malachite green respectively.

Table 2

Color	Pigment	Appearance of zone clearance
Pale yellow	No pigment	Positive

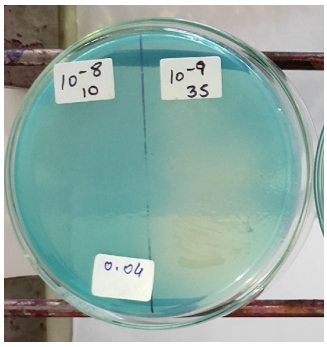


Fig. 1. Decolourization was observed on the nutrient agar plate containing 4 ppm of the dye.

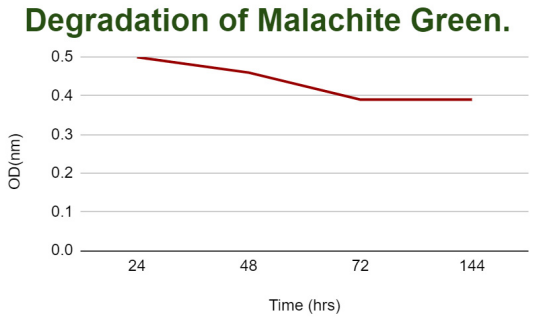
Biochemical Test

Organisms were inoculated in biochemicals and incubated at 25°c +/- 2°c for 24 hrs.

From the dye decolourization it was observed that as the time increased the decolourization of the dye also increased. The total decolourization of Malachite green was observed within 72 hours, under static conditions.

Discussions

In the present study the *Citrobacter spps.* was isolated and identified from the dumping yards of Boisar



Graph 1

Table 1

Shape	Size	Margin	Opacity	Color	Elevation	Consistency	Gram staining
Circular	0.1	Entire	Opaque	Pale yellow	Flat	Sticky	Gram Negative short rods

Table 3.

1% Glucose	1% Lactose	1% Mannitol	1% Sucrose	Oxidase	Catalase	Test Indole	MR	VP Test	TSI Test			Citrate
									Butt	Slant	H_2S	
⊕	⊕	-	+	+	+	-	-	+	Acidic black	Acidic	+	+

was found to efficiently degrade the 4 ppm of the Malachite Green dye, whereas in the study carried by Mukherjee and Das (2013); it was found *Enterobacter asburiae* Strain XJUHX-4TM isolated from dye contaminated wastewater was potent to degrade 1000 mg/l of the Malachite green.

Roy *et al.* (2020), observed that *Enterobacter* CV-S1 and *Enterobacter* CM-S1 decolorized 100% Malachite green at a concentration of 15 mg/l within 78 h and 144 h respectively. whereas in present study it was found that the complete decolourization of 4 ppm of Malachite green took 72 hours by *Citrobacter* spps. under static conditions.

Conclusions

The Malachite green dye was degraded by the soil microorganisms of the dump yard. On carrying out the tests for Bacterial identification, *Citrobacter* spps. efficiently degraded 4 ppm of Malachite green in 72 hours under static conditions.

The experiments on degrading the dyes with the help of biological methods will help the environment largely. The obtained microbes can be augmented to reduce the time required for decolorization making them more applicable for industrial level.

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Conflict of Interest

The authors declare no conflict of interest

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