Biodegradation Ability of *Pseudomonas aeruginosa, Proteus spp. and E.coli* To Decolorize Synthetic Dyes; Crystal Violet and Malachite Green

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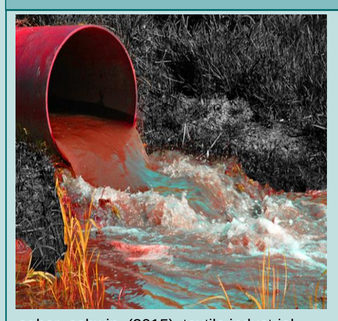
Introduction



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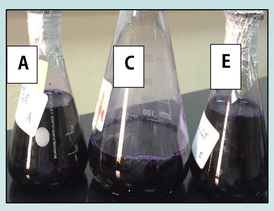
Triphenylmethane dyes have been used intensively by textiles, food, cosmetic and painting industries. However, because of its negative impact on environment and human health, there are interests in improving and developing techniques to treat contaminated environments and degrade these dyes into less toxic compounds (Bhatia et al., 2017). Bioremediation techniques have been applied to treat the contaminated environments by using naturally occurring microorganisms or their enzymes to breakdown recalcitrant compounds (Kumar et al., 2011). Microorganism have been shown to have different abilities in biodegradation of contaminates, and some exhibit some advantages over other, and the bacteria show good abilities among other (Ali, 2010). The effectiveness of microbial biodegradation ability depends on the adaptability and the activity of the selected microorganisms, temperature, carbon source, concentration and chemical structure of dye, pH, nitrogen source, culture condition and presence of oxygen (Zabłocka-Godlewska et al., 2014).

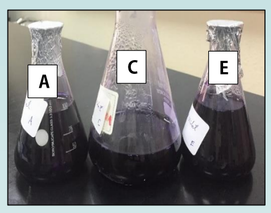
Methodology

The present study evaluated bacterial decolorization activities of *Escherichia coli, Pseudomonas aeruginosa* and *Proteus mirabilis* on crystal violet (CV) and malachite green (MG) at different temperatures for 72 hours. Decolorization of crystal violet and malachite green by bacteria species were measured by UV-Visible spectrophotometer, wavelength used were λ max= 620nm for malachite green and λ max=580nm for crystal violet. The absorbance was measured on the three days. Decolorizing rate % was calculated by:

$$\text{Decolorizing \%} = \frac{inintial\ absorbance - final\ absorbance}{initial\ absorbance} \text{X100}$$

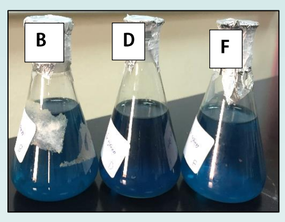


Picture 1



Picture 2

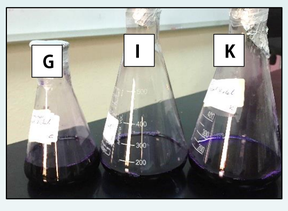
Pictures 1&2:Flasks contain CV with bacteria at 37℃. (A) CV and *P. aeruginosa*.(c) CV and *E. coli*. (E) CV and *Proteus* on day 1 and day 3 respectively.



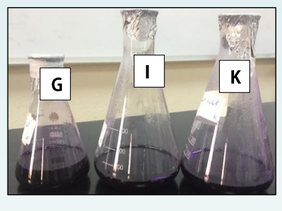
Picture 3

Picture 4

Pictures 3&4: Flasks contain MG with bacteria 37℃. (B) MG and *P. aeruginosa*. (D) MG and *E. coli* (F) MG and *Proteus* on day 1 and day 3 respectively.

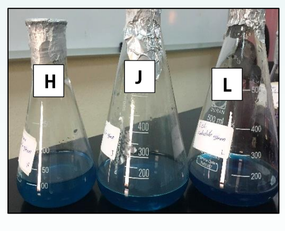


Picture 5

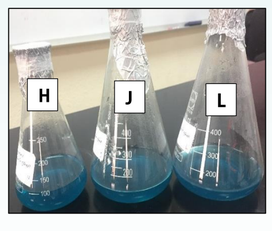


Picture 6

Pictures 5&6: Flasks contain CV with bacteria at room temperature. (G) CV and *P. aeruginosa.* (I) CV and *E. coli*. (K) CV and *Proteus* on day 1 and day 3 respectively.



Picture 7



Picture 8

Pictures 7&8: Flasks contain MG with bacteria at room temperature. (H) MG and *P. aeruginosa*. (J) MG and *E. coli.* (L) MG and *Proteus* on day 1 and day 3 respectively.

Results

The decolorization was maximum at room temperature than at 37 ℃ as shown in figure 1. Among different bacteria,

- *E.coli* decolorizing both CV and MG at 37℃ and at room temperature (RT) on both the days.
- *P. mirabilis* exhibited the highest decolorizing rate on MG on both days at room temperature (RT), but had no effect on CV at 37^{0}C.
- *P. aeruginosa* showed good decolorization of MG at 37℃ and exhibited minimal decolorization of CV only on the third day.

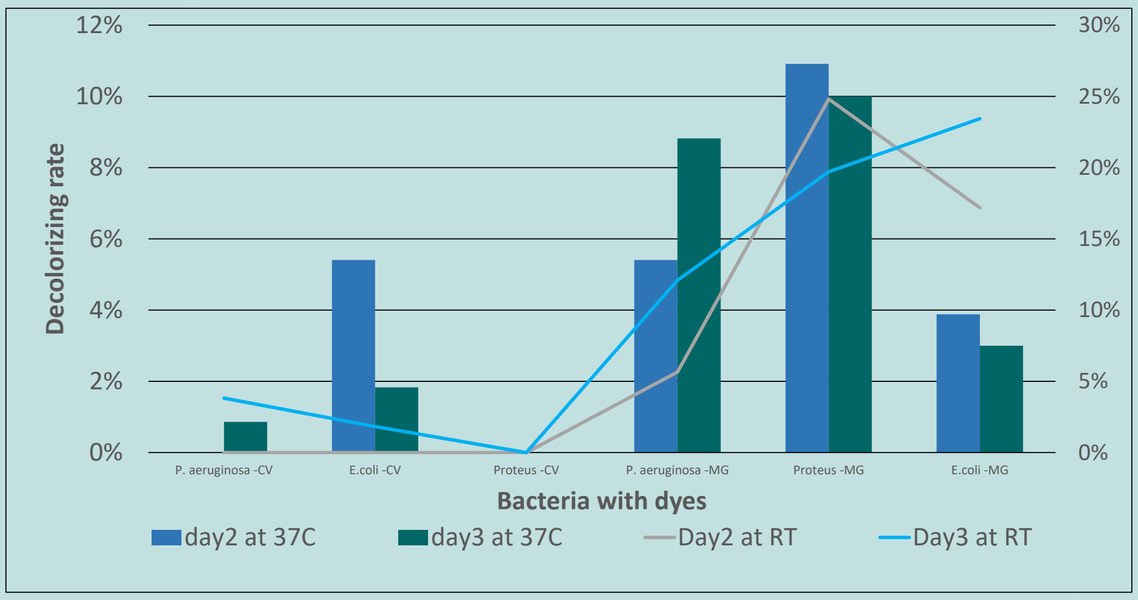


Figure 1:decolorizing rate of CV and MG by *E. coli, P. aeruginosa* and *P. mirabilis* at 37^{0}C and RT.

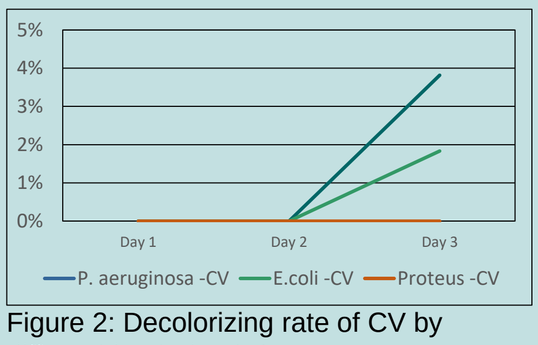


Figure 2: Decolorizing rate of CV by different bacteria at RT.

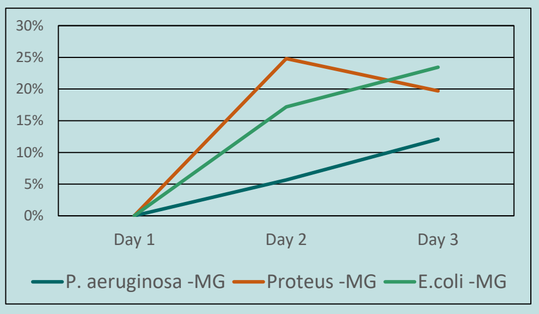


Figure 3: Decolorizing rate of MG by different bacteria at RT.

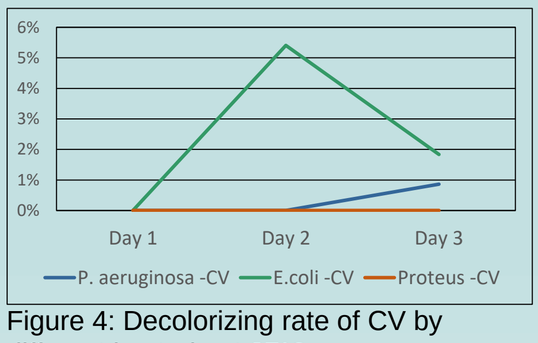


Figure 4: Decolorizing rate of CV by different bacteria at 37℃.

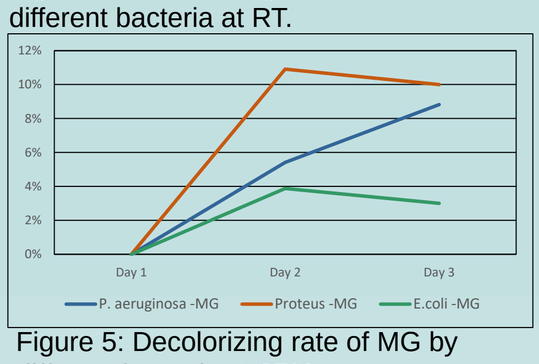


Figure 5: Decolorizing rate of MG by different bacteria at 37℃.

Conclusion

All the bacteria demonstrated good effect on decolorization of the triphenylmethane dyes at RT and 37℃, except for *P. mirabilis* which had no effect on CV at 37℃. However, bioremediation has a lot of advantages that encourage using it over another technique. Bioremediation offers better benefits over other techniques because it is environmental friendly, produces less toxic compounds such as carbon dioxide and water, and low amount of sludge. Whereas physiochemical techniques show the opposite of these features.

References

Ali, H. (2010). Biodegradation of Synthetic Dyes—A Review. Water, Air, & Soil Pollution, 213(1-4), pp.251-273.

Bhatia, D., et al, (2017). Biological methods for textile dye removal from wastewater: A review. Critical Reviews in Environmental Science and Technology, 47(19), pp.1836-1876.

Kumar, A., et al, (2011). Review on bioremediation of polluted environment: A management tool. International journal of environmental sciences, 1(6), p.1079.

Zabłocka-Godlewska, E., et al, (2014). Decolourisation of Different Dyes by two Pseudomonas Strains Under Various Growth Conditions. Water, Air, & Soil Pollution, 225(2).

AGHOR, A. S. H. W. I. N. (2015, December 1). Govt moves to curb pollution by textile units. But it may do more harm than good. Retrieved from https://cutt.us/rfsys

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