REIMAGINING THE PURPOSE OF ENERGY EDUCATION BEYOND CONSERVATION

Editors

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STUDY ON DEGRADATION OF METHYLENE BLUE USING AZOLLA PINNATA AS BIOFILTER

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Abstract

Azo dyes are the largest class of synthetic dyes which are utilized in several industries. Effluents containing dyes which is released in to the environment and cause harm to humans who might be exposed to these contaminants. This study explains the removal of methylene blue (MB) dye using aquatic plant Azolla pinnata. Decolourisationof Methylene blue dye was developed using the aquatic plant Azollla pinnata as biofilter. Three different concentrations of dye were employed (5, 15, 25 mg/l) with 3 g of Azolla pinnata. The physic-chemical parameter wasanalysed which include DO, pH, Temperature. The DO of the water was also found to be increased in each concentration. The pH of the water sample brought more toward neutral after treatment.

Keywords: *Azolla pinnata; Methylene blue; Degradation; Biofilter.*

1. INTRODUCTION

Color is a necessary aspect of the human world. We like to wear clothes from all kinds of colors and hues, eat food decorated with colors, even our medicines are colorful. Historical records of the use of natural dyes derived from plants, animals, fruits, insects, minerals and other natural resources back to 3500 BC have found. Moreover, natural dyes are usually accepted as harmless and eco-safe. However, it can be toxic due to the mordant used for their application. The production of natural dyes requires a vast area of land, they are scarce and expensive. The sustainability dyes are a problem because it will be fading off by sunlight and washed off by time. The mill effluent is also often of high temperature and pH both of which are extremely damaging. The discharge of effluent without proper treatment can get mixed with surface and groundwater and eventually can enter into drinking waters. Furthermore, dye effluent if discharged untreated affects the photosynthetic of aquatic plants by preventing the light to penetrate through water (Purkait et al 2007). Loss of dissolved oxygen in water is the main cause effect of textile waste as dissolved oxygen is very essential for marine life. This also hinders with self-purification process of water.

II. METHODOLOGY

a. Analysis of Physico chemical parameters

Physico chemical parameters like Dissolved Oxygen (Winkler's Method), pH and temperature (IQ 150 Multiprobe) were determined for the dye-contaminated water using standard laboratory procedures.

b. Analysis of dye decolorization

The absorbance values of samples were determined by a Spectrophotometer at maximum wavelength 665nm. The decolori-zation percentage was calculated based on initial and final absorbance (Khataee et al., 2012; Warthakar et al., 2013).

$$\% \text{ Decolorisation} = \frac{A0 - A}{A0} \times 100 \quad (2)$$

Where: A_0 = the initial absorbance (Day 0), A=the final absorbance after exposure to AP (Day 5)

III. RESULTS AND DISCUSSION

a. Monitoring the major Physico chemical parameters

Figure 1 shows DO value increased significantly in all the three treatments of concentration 5, 15, 25 mg/l. The increased in the Dissolved Oxygen level can be explained through the Azolla, being an aquatic plant produces oxygen by the process of Photosynthesis. Which leads to the increase in amount of the dissolved oxygen. In a study conducted by Devi et al (2014) shows

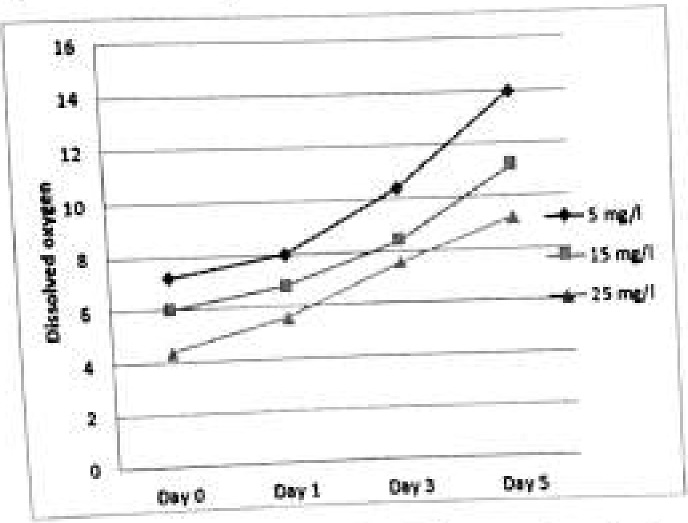

Fig.1: Dissolved oxygen of MB dye contaminated water

the increase in DO value of wastewater after treatment with A. pinnatta. This gives the conclusion that Azolla can be used as a good and reliable agent of methylene blue removal. The pH values range from 6-7 throughout the 5 days respectively. Comparing to Khateeet al (2012) study, they had proved that the suitable pH for growth and activity of L. minor, dye removal, range of Ph 6-7.5. The pH of the water is brought more towards neutral, i.e., it has become more portable as a result of Azolla treatment. This may be a result of absorption of the ions and present in the dye contaminated water by Azolla. In a study conducted by Devi et al (2014).

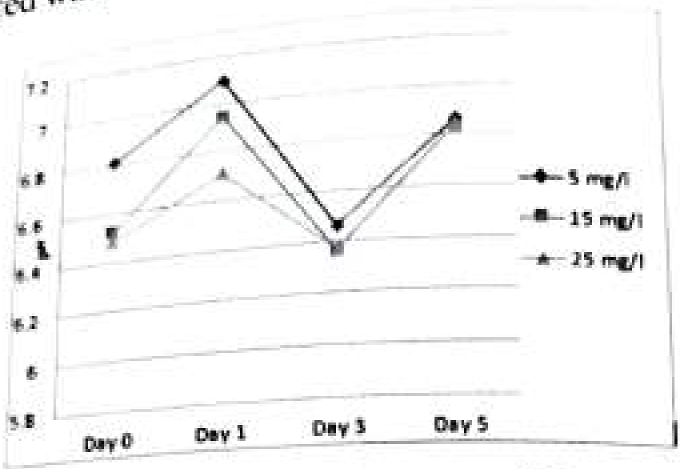

Fig 2: pH of MB dye contaminated water at different concentration

Fig 2 shows the pH value approaches to neutral in the case of wastewater after treatment with A. pinnatta.

a. Performance of Azolla pinnata in the decolorization experiments

The absorbance according to UV-Spectrometer reading were 0.07, 0.5, and 1.5 at day 0 and decreases to 0.01, 0.04, and 0.1 after 5 days for 5, 15, and 25 mg/L MB-dye concentrations respectively as illustrated in Fig.3. Decolourization after 5 day-exposure of A. pinnata were 76, 93, and 95% MB removal with the three different MB-dye concentrations (5, 15, and25mg/L) respectively. Huichenget al. (2012) concluded that average percent decolourization of the azo dyes at 100mg/L within 4 days was 62.64%by Sunflowers. As shown in Fig.3, the high removal laws clearly observed within the first day (after24h) with 25mg/L MB concentration, therefore the decolourization experiments were repeated with hourly observation for 25mg/L MB concentration. The results show that A. pinnata is an excellent biofilter in field of water treatment biotechnology.

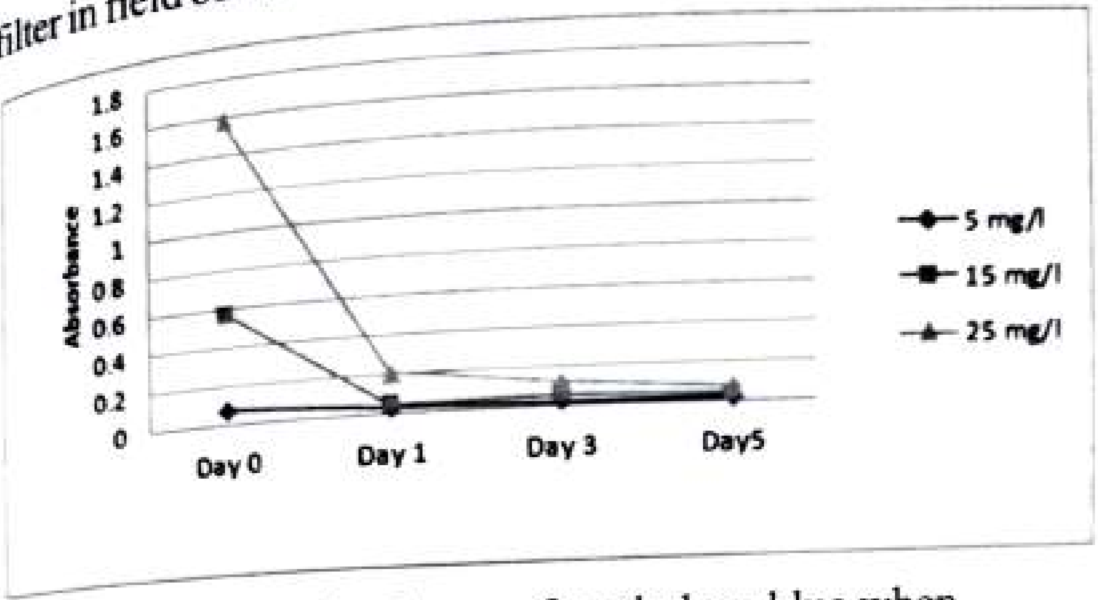

Fig.3: The absorbance of methylene blue when exposed to A. pinnata for 5 days

IV. CONCLUSION

In this paper, investigated the phytoremediation efficiency of A. pinnata for methylene blue dye removal from dye contaminated water. The maximum phytoremediation efficiency was obtained under the optimized conditions derived from the study of various operational parameters influence. The result of this study shows the good potential of the A. pinnata aquatic plant on the removal of MB dye from water, which propels it as a promising biofilter in future wastewater treatment applications.

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This book constitutes the refereed proceedings of the First International Conference on Sustainable Energy Education, ICSEE 2021, held in Department of Education, University of Kerala, on 10-12, January, 2022 in the online mode. The conference discussed "WHAT" of energy education - should be. It then asks the contributors to bring forth their best ideas regarding "HOW" to implement the education process, and finally "WHY" we should be educating about energy. We hope that the interesting scholarly work and case studies that the contributors have brought us, will trigger an on-going dialog about how to frame energy education in the much bigger picture of energy cycles and their fundamental importance to powering our life, and its increasingly energy - hungry industrialized, urbanized and digitized infrastructure. The book serves as a reference resource on sustainable energy education for researchers and practitioners in academia and industry.

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