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Adsorptive removal of dye from waste water by using activated carbon synthesized from *Leucaena leucocephala*

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Abstract

The large capacity of waste water production due to the rapid growth of industries has resulted in limited water resources. The need to protect and conserve water resources have enforced researchers worldwide to focus on the development of an effective, economical, and environmentally friendly novel materials. In this study we synthesized activated carbon from the flower stem of *Leucaena leucocephala*. Activated carbon was used in the removal of malachite green dye and methyl orange dye.

Keywords: Activated carbon, waste water treatment, green synthesis.

Introduction

Since dyes have a synthetic origin and complex aromatic molecular structures, they are inert and difficult to biodegrade when discharged into waste streams. This aspect has always been overlooked in their discharge. The removal of synthetic dyes is of great concern, since some dyes and their degradation products may be carcinogens and toxic and, consequently, their treatment cannot depend on biodegradation alone [1,2]. There are advantages and disadvantages of various methods of dye removal from wastewaters. Many physicochemical methods have been tested, but only that of adsorption is considered to be superior to other techniques. This is attributed to its low cost, easy availability, simplicity of design, high

efficiency, easy operation, biodegradability and ability to treat dyes in more concentrated forms. Activated carbon adsorption is one such method which has a great potential for the removal of dyes from wastewater [3-6]. This has led to the search for cheaper substitutes. Hence, low-cost activated carbons based on agricultural solid wastes have been investigated for a long time. Agricultural by products and waste materials used for the production of activated carbons include plum kernels [6], cassava peel [7], bagasse [8], jute fiber [9], palm-tree cobs [10]. *Leucaena* is a genus of plants in the family Leguminosae, which includes flowering plants. It has been shown that this species has a great deal of promise for Malaysian timber plantation plants

(MTIB 2017). Research has revealed that *L. leucocephala*'s trunks and branches can be utilized as raw materials to make composite goods such oriented strand boards. It is known as a multipurpose tree and is widely used in gum production, furniture, construction timber, poles, etc. [11],[12].

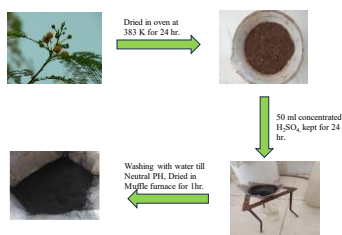
In present study the results of removal of malachite green dye from aqueous solution by adsorption onto activated carbon prepared from flower stem of *Leucaena leucocephala*.

1. Materials and chemicals

Leucaena leucocephala flower stems were collected from botanical garden of Balwant college, Vita. Conc. H_2SO_4 , Sodium hydroxide (NaOH), Methyl orange dye, Malachite green dye, solvent (usually water) Heating apparatus (like a hot plate) Magnetic stirrer, Centrifuge, UV spectrophotometer.

2. Activated carbon preparation

The adsorbent was prepared from a dry flower stem. The stems were crushed into small pieces, washed with double distilled water, and dried in an oven at 383 K for 24 h. 25 g dried sample was put in a container and 50 ml concentrated H_2SO_4 was added as an impregnating reagent, then kept for 24 hr.



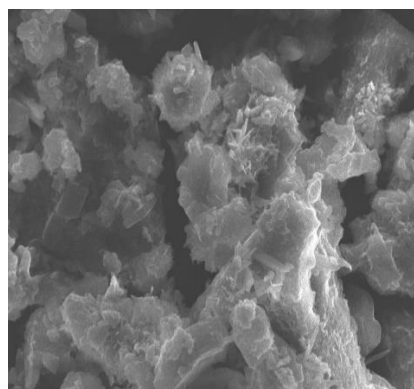
After the acid was leached out the sample was washed with distilled water till neutral pH. For complete formation

as carbonaceous material, it was kept in a muffle furnace, for 1 h at 573 K. crushed to a particle size of 125 μm and finally stored in an airtight container for further analysis.

Characterization techniques

SEM Analysis

From SEM analysis a rough surface morphology was observed



Results and Discussion:

PH Study (Parameter)

100 ppm solution of malachite green dye and methyl orange dye solution was taken in three different conical flasks (50ml) and 0.050 gm of the composite was added in each flask and shaken for 2hrs in an orbital shaker (maintained in pH 5, 6, 7, 8 by using solution HCl and NaOH) (Shown in fig. 2)

Table No. 1

Activated carbon for Malachite Green Dye

Sr. No.	PH	Absorbance
1	5	1.522
2	6	0.736
3	7	0.651
4	8	0.358

Table No. 2
Activated carbon for Methyl Orange dye

Sr. No.	PH	Absorbance
1	5	1.375
2	6	0.837
3	7	0.325
4	8	0.401

From above observation it is concluded that Malachite green dye show maximum adsorption at PH 8 and Methyl Orange at pH 7 (**Table No.1 and Table No. 2**)

PH 8 kept constant and the weight of activated carbon was varied from 0.06 gm, 0.07 gm, 0.08 and 0.09 gm for malachite green (**Table No. 3**) and methyl orange (**Table No. 4**)

Table No. 3

Sr. No.	Weight	Absorbance
1	0.06	0.310
2	0.07	0.294
3	0.08	0.056
4	0.09	0.033

Table No. 4

Sr. No.	Weight	Absorbance
1	0.06	0.290
2	0.07	0.254
3	0.08	0.036
4	0.09	0.023

Fig. No. 2 Methylene blue dye after adsorption



Conclusion:

In this study, activated carbon was successfully developed from *Leucaena leucocephala*. The potential applicability of activated carbon was tested on the uptake of Malachite green dye & Methyl Orange dye respectively. The effect of the pH parameter was tested. From experimental data & UV spectrometer readings, it is concluded that activated shows maximum adsorption of Malachite green dye at pH 8 & Methyl orange dye at pH 7 respectively. Can be effectively used in the removal of dyes.

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