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Bio Adsorption Study of *Tabernaemontana divaricata* Leaves Ash

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Abstract: ***The application of activated leaf ash of T. divericata for the removal of methyl orange from aqueous solution was investigated in this study. Five dilutions of 10 µg/ml of synthetic dye methyl orange were prepared as adsorbate and 10 mg, 20 mg, 30 mg, 40 mg and 50 mg activated leaf ash of T. divericata as adsorbent used for bio adsorption study. The maximum bio-adsorption was found when 97 mg/100 ml methyl orange dye was absorbed by 50 mg amount of leaf ash adsorbent. This study concluded that T. divericata leaves, which are abundantly available, can be utilized as efficient bio adsorbent for the removal of methyl orange from waste water release from industries.***

Keywords: *Tabernaemontana divaricata*, Leaves, Methyl Orange, Adsorption activity**,** Bio adsorbent

1. Introduction

In many countries industrial sector extensively uses synthetic dyes for coloring products, producing large quantities of colored wastewater through the different dyeing and finishing processes [1]. The removal of dyes from effluents of textile, paper, plastic and cosmetic industries is one of the active areas of pollution control research [2].

Various parts of different plants as bio adsorbents have been explored for their adsorption abilities towards methyl orange as use in many applications. Increasing research interest is being envisaged during the recent past, in exploring the adsorption potentialities bio-waste materials of flora and fauna origin in controlling the polluting ions. These bio-processes along with other chemical processes are proving to be potential alternative to the existing methods of detoxification and for the recovery of toxic and valuable ions from industrial discharges and polluted waters **[**3].

Available methods for the removal of dyes from textile effluent include coagulation-flocculation [4], electro chemical oxidation, biodegradation, ion exchange [5], ozonation [6], adsorption by activated carbon [7]. However, these methods do not result incomplete removal of dyes from the effluent. As mentioned, conventional methods of sewage treatment and other biological methods are not suitable for the treatment of dye effluents due to the inability of micro-organisms to break down these compounds.

Progress in industrialization in particular textile industries have led to the discharge of unprecedented amount of wastewater containing synthetic dyes, which pollutes the rivers and consequently causes harm to human and other living organisms [8]. Most of the synthetic dyes are not biodegradable and toxic. Methyl orange (MO) is a commonly used monoazo dye in laboratory assays, textiles and other commercial products and has to be removed from water due to its toxicity [9-10].

A majority of the used dyes are azo reactive dyes which are bright in color due to the presence of one or several azo (─N═N─) groups associated with substituted aromatic structures [11]. These dyes or their breakdown products are toxic to living organisms [12]. Furthermore, dyes in wastewater are difficult to remove because they are stable to light, heat and oxidizing agents. In short, they are not easily degradable [13-14]. Physical adsorption techniques are generally considered as the preferred means for removing and purifying organic substances due to their high efficiency and ability to separate a wide range of chemical compounds [15-16].

Many types of adsorbents are available for the removal of dyes. Activated carbon is the most commonly used adsorbent for removal of a vast variety of dyes but is too expensive and difficult for regeneration [17]. Therefore, there are demands for alternative low-cost adsorbents in order to make the adsorption treatment technology. The past few years have seen the successful applications of spent tea leaves [18], *moringa peregrina* plant [19], activated papaya leaf [20], corn leaves [21], various fruit peels such as watermelon rinds [22], mango peel [23], pomegranate peel [24], banana peel [25], dragon fruit peel, leaf-based adsorbents [26], etc. for removing dyes from aqueous solution via adsorption process. This study concluded that *T. divericata* leaves, which are abundantly available, can be utilized as efficient bio adsorbent for the removal of methyl orange from waste water release from industries.

2. Methodology

2.1 Adsorbent

Leaves of *T. divericata* plant from the family Apocenacy were collected from local area of Bhopal city of Madhya Pradesh, India and were washed with distilled water then dried in shed. Kept leaves at ambient temperature for 24 h and was ground using a high speed blender and sieved to isolate fibers of the size 212-350 micron. For carbonation, powder leaves were heated to 90^{o}C in hot air-oven for 6 hrs then washed with distilled water several times to make free

of acid and then dried at 80°C and preserved for further studies [27].

2.2 Adsorbate

Methyl Orange [4-dimethylaminoazobenzene-4'-sulfonic acid] (MO), bright orange crystalline powder 34 was purchased from Sigma-Aldrich. MO is dark red in aqueous solution below pH 3 and the color brightens to orange as pH increases [28].

Accurately weighed 0.010 mg of methyl orange was transferred into 10 ml volumetric flasks separately and dissolved in 5 ml of distilled water, then volume was made up to 10 ml with distilled water and vortex it to get complete dissolution of methyl orange dye to give 1000 µg/ml concentration of methyl orange. Marked this solution as stock solution and stand it aside for few minute.0.1 ml of solution was taken from stock-A of methyl orange solution transferred into 10 ml volumetric flask separately and diluted up to 10 ml with distilled water to give 10 µg/ml concentration of methyl orange.

2.3 Adsorption Study with Bio-Adsorbent

For this study, 10 µg/ml of prepared methyl orange was scanned on UV spectrophotometer (Labindia 3000 plus), and found λ max at 464 nm. Five dilutions of 10 µg/ml of methyl orange were prepared in separate test tube and 10 mg, 20 mg, 30 mg, 40 mg and 50 mg leaf ash of *T. divericata* as bio-adsorbent was added in each test tube and keep a side for 10 min and take the absorbance at 464 nm by UV spectrophotometer.

3. Result & Discussion

Result of bioadsorption of methyl orange dye in *T. divericata* leaf ash done by UV spectrophotometer is depicted in table 1 and its bio adsorption study is shown in figure 1.

Table 1: Bioadsorption of methyl orange dye by *T. divericata* leaf ash

S. No	Amount of Adsorbent (*T. divericata* leaf Ash)	Absorbance	Adsorption (mg/100 ml)
1	10	0.456	21
2	20	0.453	37
3	30	0.411	56
4	40	0.434	76
5	50	0.393	97

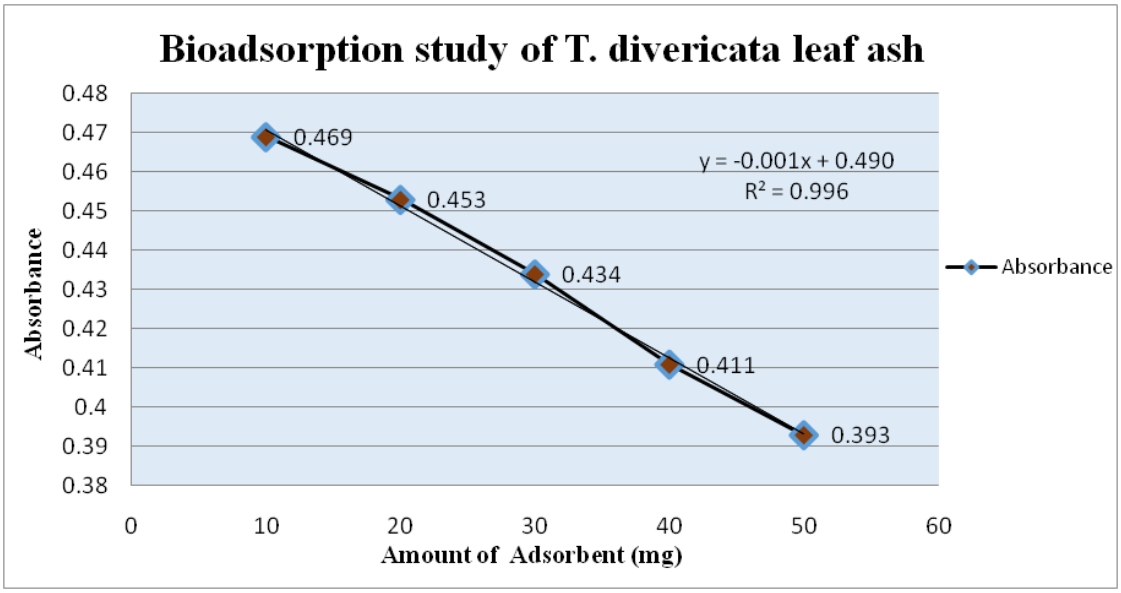

Figure 1: Bioadsorbtion study of *T. divericata* leaf ash

Bio adsorption of methyl orange was found 21 mg/100 ml in 10 mg, 37 mg/100 ml in 20 mg, 56 mg/100 ml in 30 mg, 76 mg/100 ml in 40 mg, 97 mg/100 ml in 50 mg amount of adsorbent leaf ash of *T. divericata*. The maximum bio-adsorption observed when 97 mg/100 ml methyl orange dye was absorbed by 50 mg amount of leaf ash adsorbent.

4. Conclusion

The *T. divericata* leaf ash for the removal of synthetic dye methyl orange from aqueous solution was investigated. Various low-cost adsorbents derived from agricultural wastes have been investigated intensively for synthetic dye removal from contaminated wastewater. Locally available agricultural wastes and plant materials are easily converted to charcoals which can be used as activated carbons. Therefore *T. divericata* leaves, which are abundantly available, can be utilized as efficient bio adsorbent for the removal of synthetic dye methyl orange from waste water release from industry.

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