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REMOVAL OF METHYL VIOLET (MV) FROM AQUEOUS SOLUTIONS BY ADSORPTION USING ACTIVATED CARBON FROM PINE HUSKS (PLANT WASTE SOURCES)

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Abstract

In this study preparation Pine husks as activated carbon (AC) by use HNO_3 as activation this surfers and its ability to remove textile dye (methyl violet MV), from aqueous solutions. The different limitations for example, agented time, primary (methyl violet MV)dye concentration, adsorbent amount, and temperature By using adsorption method . Result appear that the adsorption of MV neutral pH. The adsorption found losses with the dose of adsorbent, temperature but increase with increase in primary (methyl violet MV) dye concentration, and agented time of the system. That percentage removal E% (67-99%), (72-99.11%) and (83-99, 55%) adsorption efficiency (5-62 mg/g), (5-71mg/g) and (5-81mg/g) at temperature (283to 323K) at the same order **.**This study appears that the adsorption emphasize on mechanism of decomposition (Pine husks) applied as a substitutional, economical and environmentally harmless condenser for water purification.

Keywords: activated carbon, Pine husks, Textiles dye, Adsorption isotherm, Removal, Methyl violet (MV).

Introduction

Methyl Violet (MV), is a triarylmethane dye, widely used as a lilac dye to dyeing of silk and cotton in textile industry. It too finds request in the industry of printing inks, external skin disinfectant and paints, (Mahmoud, Salleh *et al*., 2012.). Methyl Violet (MV) the maximum usually used material for dying silk, cotton and firewood and application, contains temporary hair colorant ,coloring newspaper, wools, dyeing fibers, covering for broadsheet stock, etc. (Xiaoxiao, Chunyan *et al*., 2014; Adeyemo, Adeoye *et al*., 2017). It can appear different harmful effects when inhalation dye MV is so serious. output a burning sensation ingestion through the mouth however It can give difficult breathing rise to rapid time of short and may cause vomiting and gastric problem. Process for production rise capacity activated carbon not at all investigated in encasement countries. (Hari, Paruchuri *et al*., 2005; Aljeboree, Alshirifi *et al*., 2012; Abdel Salam, Abou El-Nour *et al*., 2017; Aljeboree, Alkaim *et al*., 2019). Exploring effective activated carbon and low-cost may give a share in to ecological sustainability and offer benefits for past time applications commercial. The price of activated carbon was prepare that very low from biomaterials related to the price of activated carbon commercial .waste wood consider as Waste materials that positively used to production AC in the recent past (Abdel Salam, Abou El-Nour *et al*., 2017; Danallu, Bayazitahik *et al*., 2017). In this study use waste wood of Pine husks as green treated to removal dye methyl violet (MV) from aqueous solution. The effect of parameter like, adsorbent amount, primary concentration and temperature was investigated. Too study isotherm of the adsorption as deeds the equilibrium sorption depended of the top isotherm to correlate the experimental information.

Materials and Methods

Figure 1 show chemical structure of Methyl Violet (MV) was prepared stock solution of 1000 mg/L by dissolving 0.5 g in 500 ml double distilled water the natural pH of dye MV solution was found 6.5.

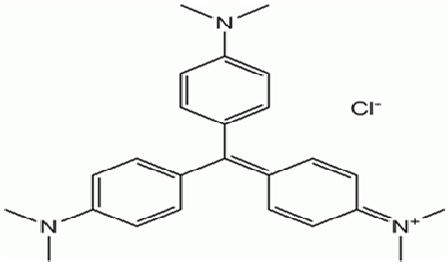


Fig. 1: Chemical structure of Methyl Violet (MV)

Preparation of HNO_3-activated carbon (Pine husks)

Pine husks were obtained from Tehran city, Iran. To make high degree of micro porosity and rise surface area via using Chemical activation HNO_3 at room temperatures .The materials was mixed (2:1 wt. ratio) on concentrated HNO_3 at 400°C for 3 h, therefore at room temperature the samples cooling after that washed with distilled water until pH of the activated carbon make pH 6, finally for 4 h dying at 110°C and sieved to gain the required (≤ 75 μm) of the particle size.

Adsorption studies

Adsorption studies of the different effect of experimental parameter (adsorbent amount, primary MV dye conc., pH solution and temperature solution) on the adsorption of dye MV on activated carbon (Pine husks). The effect of experimental factors like pH solution (3–11), activated carbon (Pine husks) dose (0. 01–0.13 gm), MV dye concentration (5–50 $mg.L^{-1}$) and solution temperature (10–50 °C). Using 0.1 N NaOH and HCl adjust the pH dye MV solution solid phase from the solution were removal through centrifugation for 10 minute at 3200 rpm in a Hettich EB 21 centrifuge, refined three times to guarantee there is any particles sparse in the absorbance measurements and analyzed utilize a UV–vis spectrophotometer at a wavelength of 452 nm. Through the calibration curve determined concentration of the solution. The concentration retained in the adsorbent phase ($qe/mg.g^{-1}$) was calculated via use equation (1) :

$$qe = \frac{(C_0 - C_e)V}{W} \quad \text{....(1)}$$

where C_0 is the primary concentration of MV dye and Ce is the equilibrium MV dye concentration (mg.L^{-1}), V is the volume of MV dye solution (l) and Ws is the amount of the AC (g), also calculate the percentage of MV dye (E%) from solution use equation (2):

$$(E\%) = \frac{C_0 - C_e}{C_0} \times 100 \quad \text{....(2)}$$

Result and discussion

Surface Characterizations

Scanning electron microscopy (SEM) has been a primary tool for characterizing the surface morphology and fundamental physical properties of the adsorbent. The micrographs presented in (Figs. 2) show clearly at natural pH conditions the dye-loaded adsorbent plated of dye molecules along the full surface. The MV dye molecules appear to have created a void-free film masking porosity of the aggregates and the reliefs of particles.

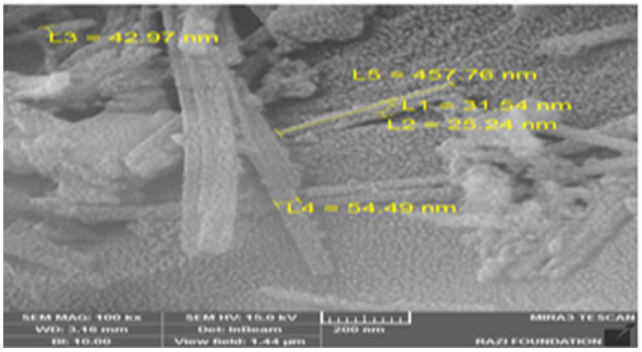


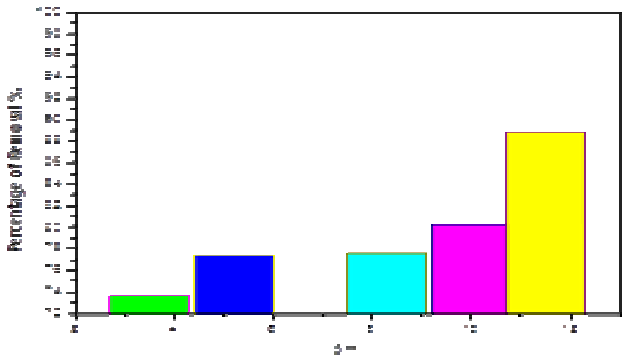
Fig. 2: SEM image for Pine husks (AC) after adsorption

Effect of Several Factors

Effect of Solution pH

The pH of the primary MV dye solution is dependent onto adsorption of the dye via use activated carbon (Pine husks). The effect of primary pH dye solution on the removal percentage (R%), adsorption capacity of activated carbon (Pine husks) is presented in Fig. 3.

As shown in (Fig. 3), with MV dye solution. to enhance the adsorption process the surface charge positively charged at rise pH, then, the increase of pH value with an increase in the adsorption of MV dye too due to the contest amidst anionic MV dye and large OH- ions in the solution, which could be payable to the truth that the rise concentration and in height mobility OH- ions are preferentially adsorbed liken to dye MV anions. While increased of pH of solution with increase in adsorption capacity of MV dye caused through engaging forces of dye and adsorbent surface (Alkaim and Alqaragully 2013; Alqaragully 2014).



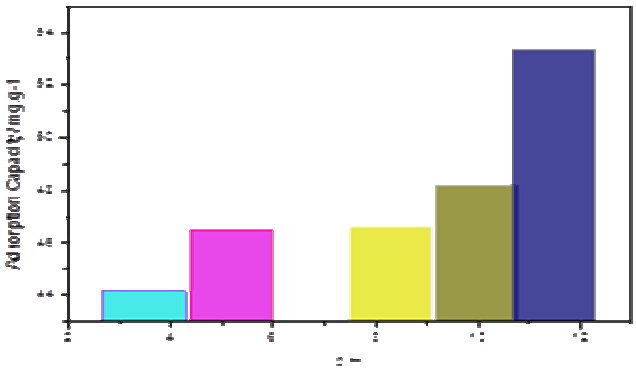


Fig. 3: Effect of pH solution on adsorption dye Methyl Violet (MV)

Effect of Pine husks(AC) mass

Effect of the Pine husks(AC) mass was needful in order of predestine the minimum potential mass, which display the maximum adsorption stoichiometric. The mass Pine husks(AC) was different (0.001 - 0.1500 gm /100 ml) of AC(Aljeboree, Al-Gubury *et al*., 2019). Results seem in (Fig. 4).

It was clear from Fig. 4 that the increasing mass of adsorbent with decrease in sorption capacity at fixed dye MV volume and concentration could be assign to overload of adsorption sites due to particulate contact like collecting (Aljeboree, Alkaim *et al*., 2015). attributed to increase in the adsorbent surface area to increase percentage removal E% of dye by adsorbent mass, increase the number of adsorption sites available of adsorption (Aljebori 2012; Aljeboree 2019).

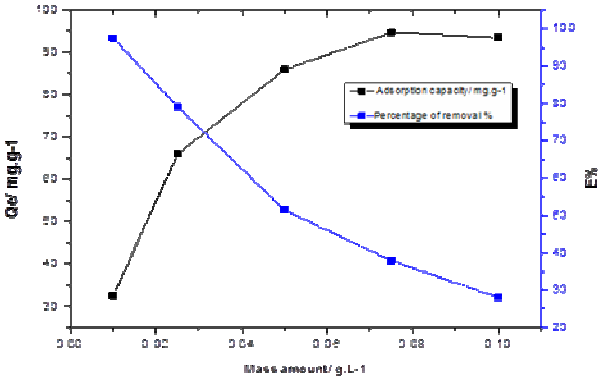


Fig. 4: Effect of mass Pine husks (AC) on adsorption dye (MV)

Effect of initial Methyl Violet (MV) dye concentration

Figure 5 appear the plot the quantities of (R%) dye removal and dye adsorbed (qe) against primary concentration C0 at various experiential conditions. the residual unoccupied surface sites were difficult to be taken due to steric barrier among Methyl Violet (MV) adsorbed on the surface of activated carbon (Pine husks) and the phase solution. Produce depended to increase in the leading power of concentration gradient with the raise in the primary concentration. Figure 5 shows that the qe/mg.g^{-1} value enhancement with the elevation in primary factor concentration as the impedance to the agreement of MV dye from the solution degrease with the high different factors concentration. Too, the increasing of Co amount would mains to an increase in the rate of adsorption due to the arising in the driving force (Aljeboree 2015; Aljeboree, Alkaim *et al*., 2015; Aljeboree, Alshirifi *et al*., 2017).

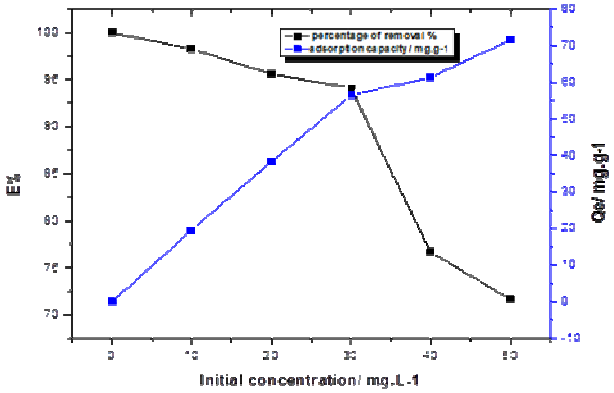


Fig. 5: Effect of primary concentration on adsorption of *(MV)* textile dye (methyl violet MV) via Pine husks (AC) .

Effect of solution temperature

To locate if the adsorption method was exothermic, endothermic in nature. estimation the adsorption isotherms used for changed dye(MV)- adsorbent method and study the removal percentage E% of Methyl Violet (MV) at different temperature (288, 298, and 313 K) (Aljeboree 2015).

The results indicate that the adsorption efficiency and percentage removal E% of Methyl Violet (MV) onto the adsorbent surface of AC was found depended of the temperature. It is perfect that the adsorption capacity (Qe) and E% increase cases to increase temperature. That percentage removal E% (67-99%), (72-99.11%) and (83-99,55%) adsorption capacity (5-62 $mg{\cdot}g^{-1}$), (5-71 $mg{\cdot}g^{-1}$) and (5-81 $mg{\cdot}g^{-1}$) at temperature (288to 323K) at the same order show in figure 6 (Ji, Liu *et al*., 2010; Alkaim, Zainab *et al*., 2015; Aljeboree and Abbas 2019).

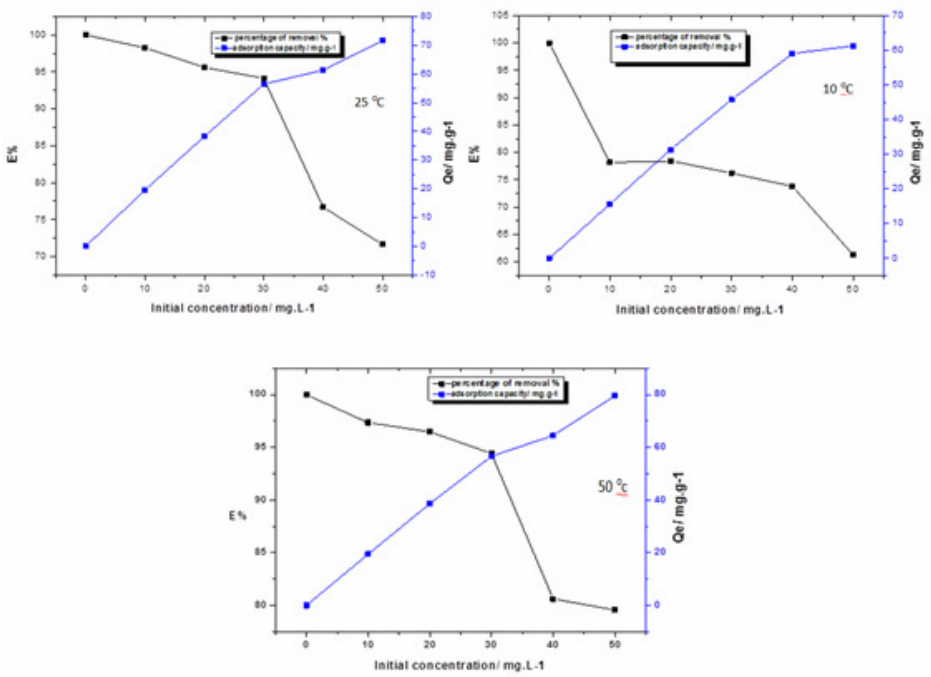


Fig. 6 : Influence of resolution temperature on adsorption of dye (MV) using The exterior of AC a)Temp 15°C b) Temp 25°C C) Temp 50°C

Conclusions

In this study to removal of textile dye Methyl Violet (MV) use Pine husks (AC) as an alternative adsorbent surface. The operational factor like adsorbent mass, pH solution, ageist time, solution temperature, were found to have an effect with adsorption capacity of AC . The adsorption was rise Pine husks (AC) on reaction pH and temperature solution. Textile dye (methyl violet MV) was optimally adsorbed at pH 11. The maximum adsorption capacity of dye MV on AC was found to be 95.13 mg/g. These results appear that dye MV canister effectively removed from aqueous solution employing AC as inexpensive adsorbent.

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