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REMOVING METHYLENE BLUE DYE BY USING TWO TYPES OF ACTIVATED CARBON PRODUCED FROM DEAD LEAVES OF *CONOCARPUS L.*

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Abstract

A series experiments of adsorption were performed to remove methylene blue dye from its solutions via two types of carbons (AC W and AC N) produced from dead leaves of *Conocarpus L.* in lab. to test the influence of time , concentrations of the dye and amount of activated carbon. The removal percentage of the dye on AC N and ACW (94.5% and 84.3%) was quick in first (10 minutes) and after 160 minutes, the amount of MB dye removed (96.8% and 92.4%) was almost constant and the highest percentage was 97.4% and 95.9% at 30 and 15 mg /l of MB concentration, while the highest removal was 98.2 and 93.6% at 4 and 8 g of AC N and AC W dose respectively. In the case of activated carbon washed with EDTA, Na2 (AC W) the percentage removal of the dye, slightly reduced as compared to natural activated carbon (AC N).

Key words : *Conocarpus* L.; Adsorption; Methylene blue; Activated carbon.

Introduction

The industry of textile is considered one of the major threats because of the different processes that take place in this industry, which produce large volumes of gaseous, solid waste and liquid. This industry use different chemical compounds and large content of water in manufacturing stages and mainly in preparation chemicals and washing (Choy *et al*., 2000).

The properties of textile industry discharges are different and depends on the manufactured woven type and used chemicals. The produced waste water contains large amounts of material that causing the destruction of the environment and human health, including suspended material ,dissolved solids and BOD /COD ratio is often up to 4:1, which refers to the existence of non-biologically decomposed material (McConvey and McKay, 1985). Textile industry discharges also contain trace elements such as chromium, arsenic, copper and zinc which cause effects on the environment (Allègre *et al*., 2006). Changes of the colour producing from exist of dyes interact with the sun radiation in the water environment and slow photosynthesis, thus reduce activity of plant and also interacting with the dissolved gases in aqueous environment (Garg *et al*., 2004). Moreover, the dyes can increase the BOD and then decline the oxygen back into the water bodies (reoxygenation process) which prevent the growth of organisms (Robinson *et al*., 2002).

The inorganic materials in textile industry discharges makes the water is unacceptable for organism because of the existence of high concentrations of dissolved alkaline compounds, as it found that at low concentrations is toxic to aquatic life (Nassar and Magdy, 1997: Al-Degs *et al*., 2008). So the human exposure to textile dyes may cause significant health problems, ranging from simple effects to the effects of carcinogenic and mutagenic as it found that the dyes can cause serious damages to skin, causing headaches and nausea, as well as the events of birth defects (Sabio *et al*., 2004).

Materials and Methods

To investigate the efficiency of two types of activated carbon (AC N and ACW) that produced from dead leaves of *Conocarpus L.*. The first was without any treatment (natural) and the second was washed with EDTA, Na_2 to remove the MB from it's solutions. Experiments of adsorption were achieved at lab. Temperature by using important parameters, adsorbent amount (activated carbon produced from dead leaves of *Conocarpus* L.) 1,2,4,6 and 8g, dye (MB) concentrations 5,15,30,60 and 90 mg/l and contact time 10,20,40,80 and 160 minutes

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(Sarioglu and Atay, 2006; Soni *et al.,* 2012; Öden and Özdemir, 2013).

Preparation of aqueous solutions polluted with MB dye

The concentration of MB dye with 1000 mg/l obtained via placed the needed amounts of MB(colorant) in a deionize H_2O and desired solutions concentrations of colorant were prepared by successive dilution to perform adsorption experiments.

Experiments of adsorption

A series experiments of adsorption were performed by using different conditions of batch experiment. Specific amount of two types of ACC were placed into flasks (250 ml) containing 100 ml with desired concentrations of the dye at required pH values. Then, the flasks were shaken at 250 rpm speed. The last dye concentration was obtained by ultra-violate-visible spectrophotometer (665nm. Wavelength). The percent removal (R%) of the dye counted via expresion 1: (Öden and Özdemir, 2014).

$$R\ \% = \frac{Co - Ce}{Co} \times 100 \quad \dots (1)$$

C_o and C_e were first and last concentration of MB mg /l.

Amount of MB that adsorbed on AC in each time counted via expression 2 (Gusmão *et al*., 2013).

$$qt = \frac{Ci - Cf}{w} \times v \quad \dots (2)$$

qt : MB quantity adsorbed (mg per g AC at time t), *V* ; the colorant solution volume, *Ci* and C_f ; first and last quantity of the colorant mg /l, and *w* ; AC (g).

Results and discussion

Contact time effect

The agitation time considered as significant factors that affect the valuation of effective use of sorption phenomenon (Mulugeta and Lelisa, 2014). The agitation time impact on elimination of colorant in its aqueous solution and its adsorption on AC N and AC W was studied for the colorant amount (60 mg /l), adsorbent amount (1g) and contact time (10, 20, 40,80 and 160 minutes) at pH 6. When AC N and AC W were used, the removal of MB (94.5% and 84.3%) was fast in the first 10 minutes and after 160 minutes the amount of removed MB dye (96.8% and 92.4%) was almost constant, but colorant quantity that attached on surfaces of AC N in addition to AC W were increased from 5.67 to 5.80 and 5.05 to 5.54 mg/g respectively (fig.1 and 2).

Outcomes of the study appeared MB elimination in its solutions is higher at beginning of the experiment

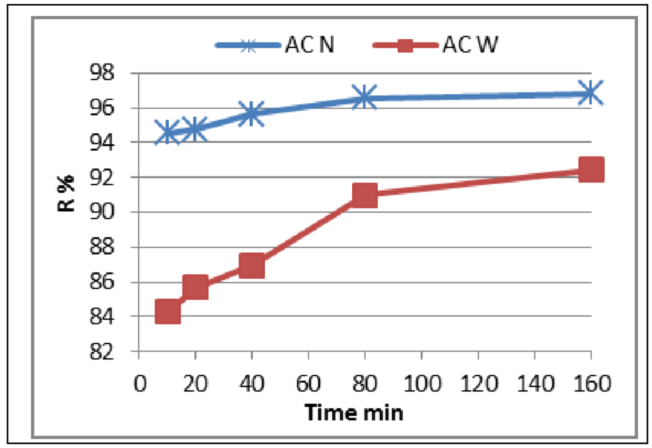

Fig. 1: Contact time effect on % removal of MB on AC N and AC W.

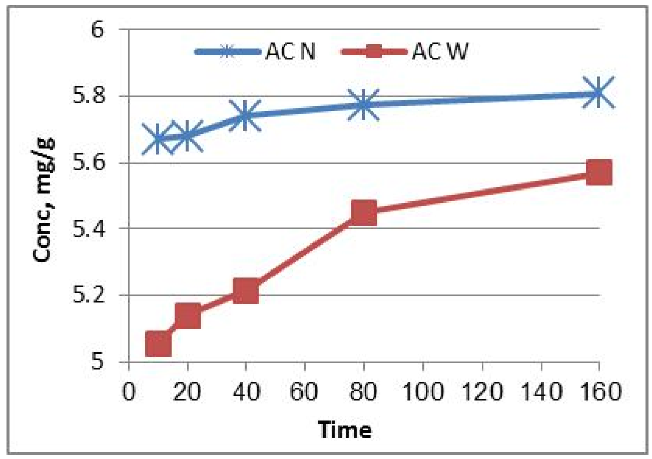

Fig. 2: Contact time effect on adsorption of MB on AC N and AC W.

because of the adsorbent (AC N and AC W) surface area availability for adsorption of the dye charges (Hameed and Ahmad 2009). Then, only a low increase of removal of colorant noted due to the less available of charges that were at adsorbent (AC N and AC W) surfaces.

Generally, at the more of contact time, the removal ability was greater because of the longer solid-liquid contact time which caused the reaction between the MB dye ions and AC surfaces .In this situation, more active surface media is exposed to the adsorbate (MB) by continuous shaking (K. Vasanth and Sivanesan. 2006). Similar observations were described by (Hameed and El-Khaiary M, 2008; Mulugeta and Lelisa, 2014).

Dye concentration effect

First colorant concentration shows an essential action on sorption phenomenon (Wang S, 2005). The colorant concentrations changed in range of 10-90 mg/l at a fixed adsorbent (AC N and AC W) dosage of 1g and contact time of 80 minute with a pH value of 6. For AC N and

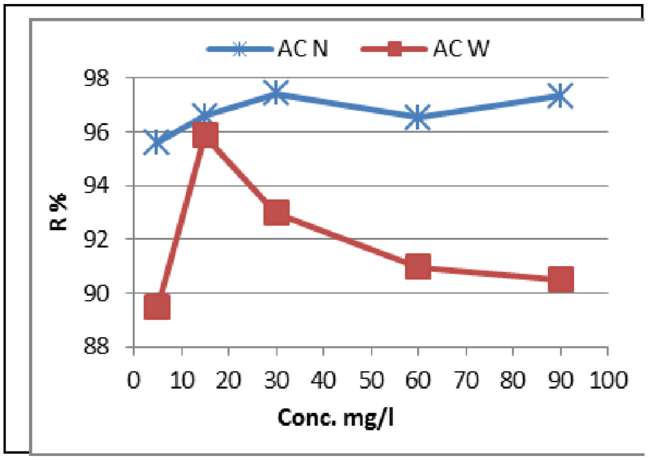

Fig. 3: Dye concentrations effect on % removal of MB by AC N and AC W.

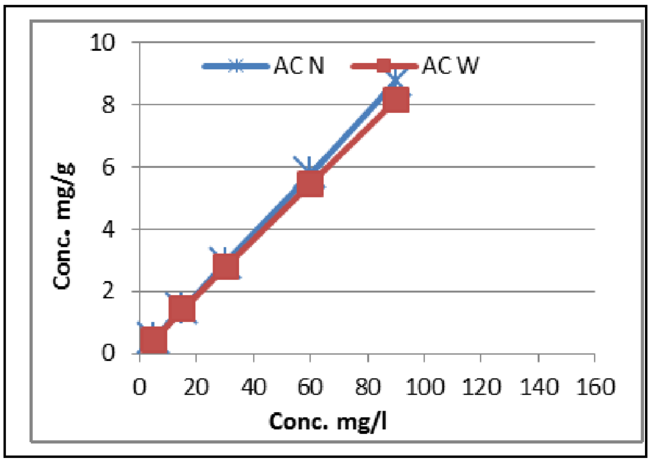

Fig. 4: Dye concentration effect on adsorption of MB on AC N and AC W.

AC W. the highest removal of the MB dye was 97.4% and 95.9% at 30 and 15 mg /l of colorant concentrations, respectively. But the highest concentrations of MB dye (mg) adsorbed on AC N and AC W(g) were 8.761 and 8.147 mg/g respectively (fig. 3 and 4). The percent colorant elimination was increased fast at first concentration of MB dye because it offers important control power to exceed all colorant weighing mobility resistances between liquid and mass forms, this indicated the first colorant amount affected elimination process of colorant (Mulugeta and Lelisa, 2014) but it gradually decreased as result of increasing of dye concentration.

Anjaneya *et al*., (2011) mentioned lower removal quantities were observed at great colorant concentration and it was suggested to occur due to obstacle impact of great colorant concentration, that noticed.

Adsorbent amount effect

The adsorbent amount effect of AC N and AC W (1, 2, 3, 4, 6 and 8 g) on colorant elimination percentage rises as the adsorbent amount rises to 4g and then decreased slightly. For AC W the colorant elimination of MB improved with rise in amount of AC (fig : 7 and 8). This may be as a result of the rise in obtainability of charges that were at carbon surfaces, obtained from the high amount of the adsorbent (Kannan and Karuppasamy, 1998; Gong et al., 2013).

Generally, in case of active carbon (AC W) washed with EDTA, Na_2 elimination process of colorant gradually reduced as matched to natural active carbon (AC N) because salt sodium may cause considerable changes

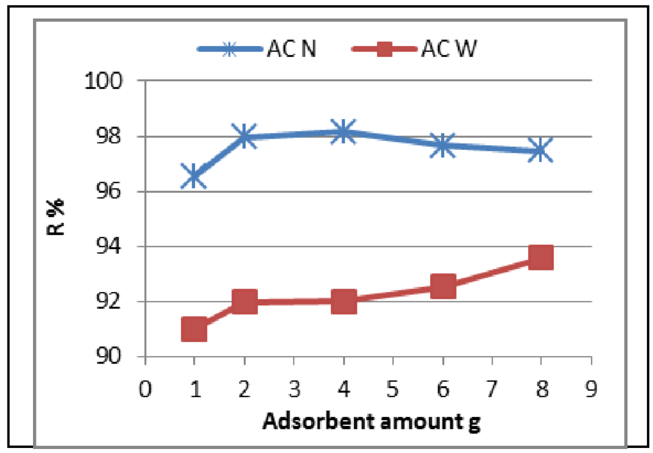

Fig. 5 : AC N and AC W amount effect on % removal of MB.

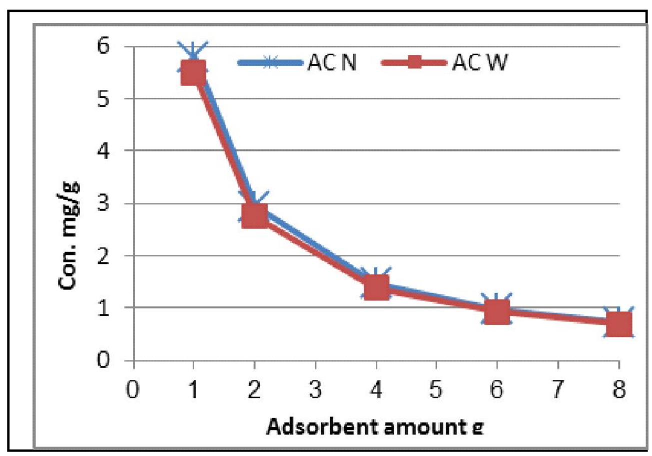

Fig. 6 : AC N and AC W amount effect on adsorption of MB.

was given in fig. 5. At affixed concentration of dye 60 mg/l and contact time of 80 minute with a pH value of 6. The results showed that the highest removal was 98.2 and 93.6% at 4 and 8 g of AC N and AC W dose respectively. but the amounts of colorant that attached on surfaces of AC N in addition to AC W were decreased from 5.79 to 0.737 and 5.45 to 0.702 mg/g respectively (fig. 5 and 6).

It is apparent for AC N, the dye removal percentage within adsorbent surface functional groups (Nady *et al.,* 2013) and then net charges. It was concluded that the removal reduction may be due to the decreasing in exchangeable sites on the surfaces of adsorbent.

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