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Purification of aqueous solutions malachite green by using cardamom seeds shells

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Abstracts

This study was conducted to find a new and cheap method to remove the malachite green dye from the aqueous solutions, the effects of four main factors on the adsorption process was studied, results show that the best contact time for adsorbing the malachite green dye was 150 min. which give removal efficiency more than R% = 76, we found that the increase in the initial dye concentration lead to the increase in R%, the highest R% reached was 79.8 at initial dye concentration 100 mg/L, the results also show that the R% was increased with the increase in the Adsorbent weight , the highest R% recorded was 82.7 when adding 2 gm of cardamom seed shells, the final factor studied was pH value the R% was increased with the increase of pH value from acidity to alkali media , the highest R% was 84.35 at pH=7.

Key words: Adsorption, water treatment, malachite green dye, cardamom.

Introduction

The waste water discharged from the activities that contain dyeing and finishing will contain many colored waste which damage the aesthetic view of water bodies, also effect the aquatic environment and represent a threat to human health[1]. One of these dyes is malachite green (M.G.) dye which used widely in textile manufacturing for dyeing leather, silk cotton and wool[2]. M.G. consider a very cytotoxic for the mammalian cells and can work as liver-tumor increasing agent[3], it is also tested by the Food and Drug administration for its toxicity and carcinogenicity [4].

Cardamom(*Elettaria cardamomum* M.) is a perennial herb, which belong to the ginger family , it also called the (Queen of spices), it is originally from India and Sir Lanka[5], many methods were done to remove dyes from aqueous solutions , one of these methods is adsorption, which is a technique used to treat polluted water which can occur in rather physical or chemical adsorption, the main

difference between the physical and chemical adsorption is that in the physical adsorption the bond between the adsorbent and the adsorbate matter is week , while in the chemical adsorption the bond is rather strong and very hard to be desorption[6],many study have been done to remove the M.G. from aqueous solutions[1,7,8,9], this search is a humble efforts to find a new and cheap treatment to remove hazardous and toxic dye M.G. from aqueous solutions.

Materials and Methods [10,11]

The adsorbate was is the malachite green dye was prepared in a concentration of 50 mg/l and volume of 1000ml.

First the stander curve was done as shown in the and Fig.1

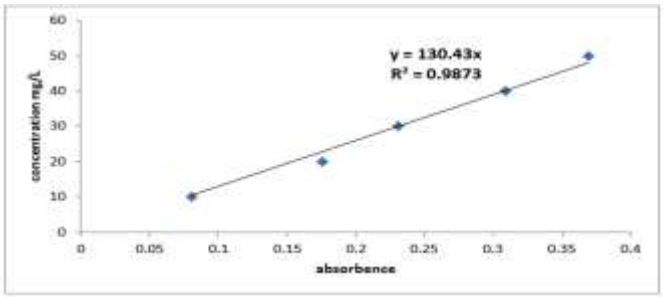

Fig.1: Stander Curve

The adsorbent which is cardamom seed shell was prepared by the activation of pores of the seed shells by soaking it in H_3PO_4(10%)for one hour and then dried in the oven at temperature of 100C□ and after that grinded by using electric motor.

Four experiments were done to determine the effectiveness of the cardamom seeds shells to remove M.G. dye from aqueous solutions, the first experiment was done to determine the best contact time , the concentration of the dye was set 50mg/l and the weight of the adsorbent was 1.5 gm , then the samples (flasks) were kept in the shaker for period 30, 60, 90, 120,150 mints respectively then the concentrations were determine by using the spectrophotometer

Second experiment was done to conclude the effect of adsorbent weight on the adsorption processes , adsorbent weight was (0.5, 1,1.5, 2,2.5gm) respectively added to solution contain the malachite green dye with volume of 100ml and concentration of the dye was 50mg/l.

Third experiment was carried out to determine the effects dye concentration on the adsorption processes, in this experiment the weight of the adsorbent was set as 1.5gm and the solution volume was 100 ml and the concentration of the dye was(10,20,30,40,50 mg/l)respectively.

For the final experiment the adsorbent weight was set as 1.5 gm and the sample volume was 100 and the dye concentration was 50mg/l and the pH was changed in order to find the effect of the pH value on the adsorption of M.G. dye , three pH value was used 3(acid), 7 (neutral) and 9 (alkali). For all 2^{nd} , 3^{rd} and 4^{th} experiments the sample were kept in the shaker for 2 hours , and then the centrifuge was used to separate the residual adsorbent and then the spectrophotometer(Optima / japan) at λmax= 617 nm [1], was used to determine the absorbance of the samples.

Results and discussion

This study was done to test the efficiency of cardamom surface in the remove of malachite green dye from the aqueous solutions, in order to do so, the study test the effects of contact time , initial dye concentration, adsorbent weight and pH value on the adsorption process. The effects of contact time on the adsorption of M.G. dye was studied first, the results illustrated in Table 2 show that the best contact time was 150 mints which give the highest R% 76, and that can be due to the fact that increase in contact time allow more dye particles to be adsorbed on the surface of the adsorbent , our result are similar to the results found by [12].

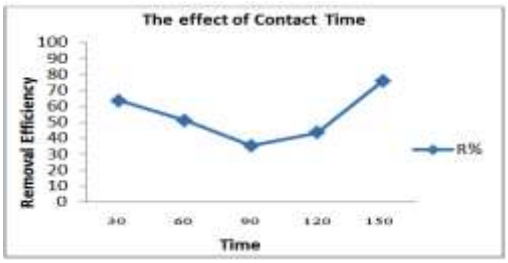

Fig.2: the effects of the contact time on the adsorption process

The second experiment was done to show the effects of the initial dye concentration, the results shown in the Table 3 show that there is an direct relationship between the initial dye concentration and R%, and that could be due to the fact that when the initial dye concentration dye increase that will means more dye molecules available to be adsorped in the adsorption site of the adsorbent, the results of this study agrees with the findings of [13],and decrease with the results of [14].

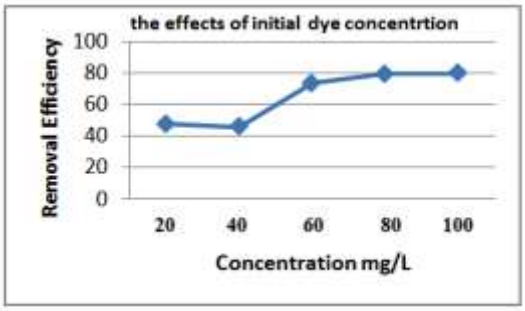

Fig.3: the effects of the initial dye concentration on the adsorption process

Also the effects of the adsorbent weight on the adsorption process, Table 4 show the effects of changing the adsorbent weight on the adsorption process , the results show that there is a direct correlation between the adsorbent weight and R% and that is due to the increase in the surface area available for adsorption[14],.the results is similar to the results found by[15]

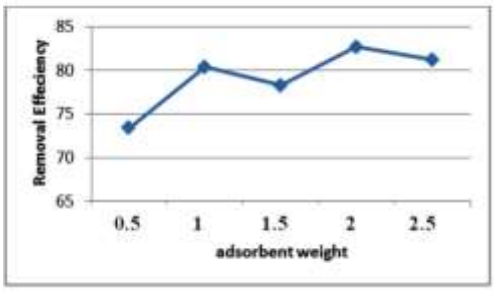

Fig.4: the effects of the adsorbent weight on the adsorption process

final experiment was done to test the effect of the pH value of the solution on the adsorption process, Table 5 show that there was a correlation between the increase in the pH value and R%, the highest R% was reached in pH value 7, the decrease of the dye adsorption at low pH value can be enlightened by the fact that at lower pH the exceeded H^+ will contended with catoion dye molecules for adsorption sites on the surfaces of the adsorbent [16].

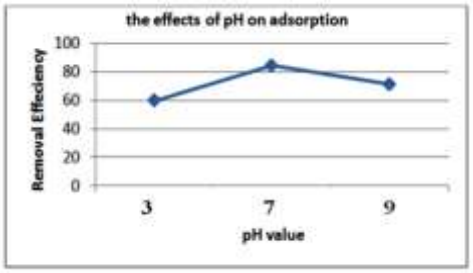

Fig.5:the effects of the pH value on the adsorption process

Conclusion:

The results of the study show that the seeds shells of the cardamom show a good and respective ability in removal of the malachite green dye, and can be used for removal of other dyes that can be consider as pollutant in the environment.

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