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Biosorption of Sifranin-O dye from aqueous solutions by using the shells of *Carbicula flumina*

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Abstract

In this study , a new and available adsorbent was used to get rid of the sifranin-O dye in the aqueous solutions, four experiments were done , to test the effects of contact time, initial dye concentration, adsorbent weight added and the changing in the pH value respectively on the adsorption process, the results show that the best contact time was 60 mints which suggested that the new proposed adsorbent *C. flumina* shell is a fast adsorbent, also it was found that the removal efficiency (R%) increased with increase of the initial dye concentration up to 40mg /L which reach R%=54.7, after that the R5 decrease, and there was a direct correlation between the increase of adsorbent weight added and the upturn R% , the results show that the removal of Sifranin-O dye increase in the Alkali medium to reach the highest R% =83.55

Keywords: Adsorption process, Sifranin-O, C. flumina, dye removal.

Introduction

Asian clam (*Corbicula fluminea*) is a bivalve mollusca which is native to southern and eastern Asia , Australia, northern Africa and south east Russia, *C. fluminea* is one of the most invasive common species of the aquatic , and that can be attributable to their high reproductive rate, early sex maturation and their short life span[1,2].

In the textile manufacturing process a great amount of water is used, and the effluent waste water from the different steps of dying textile is loaded with colors , cationic and anionic dyes, complex

component and hard degradation materials [3], these colors must be treated at the source before it can be released to the water body, many methods have been used to treat water such as coagulation-flocculation, sand filtration, fluoridation and the advanced process such as adsorption which consider as new affordable treatment method[4].Sifranin-O is a hazardous, cationic, Basic red dye , that found in the pharmaceutical and textile industries[5,6].

Many studies were conducted too remove the sifranin-o from aqueous solutions by adsorption [7, 8, 9], this study was conducted to find a new and affordable materials that can be used to adsorb the sifranin-o dye from aqueous solutions.

Materials and methods [10,11]

Preparation of the Adsorbent

The adsorbent in this study was the Asian clam (*C. fluminea*) shell , the adsorbent was prepared by sinking the shells of the clam in H_3PO_4(10%) for one hour and then the shells were dried in the oven (80 c□) tile they dried, then the shells were grinded by quern .

Preparing of the Sifranin-o dye

Stock solution of the dye was prepared by dissolving the solid dye in the distillate water to get an aqueous solution of the dye with the concentration of 50 mg/L.

Batch Studies

Four tests were performed in the batch studies:

- First one was to find the best contact time in the adsorption of the sifranin-O dye on the shells of *C. fluminea*. The experiment was done by using five samples with a concentration of 50mg/L, Volume 50 ml, and the adsorbent weight added was 1.5 gm , the test was performed for series of time (30, 60, 90, 120 and 150 mints) respectively in the shaker then the samples were transferred to centrifuge to separate the remaining adsorbent from the solution, after that the absorbance of the samples was determine by using the spectrophotometer.
- Second experiment was done to determine the preeminent weight of the adsorbent in removal of the used dye. Herein five samples were used with concentration of 50 mg/L, the sample volume was 50 ml, the time was set to 60 mints in shaker, a series of adsorbent weight (0.5, 1, 1.5, 2, 2.5 gm) was used.
- Third experiment was done to find the effect of the initial dye concentration on the adsorption process. Five samples were prepared with volume 50ml, initial dye concentration was (10, 20, 30, 40, 50mg/L) respectively. Experiment time was set 60mints in shaker and the adsorbent weight added was 1.5gm.
- Forth experiments to test the outcome of changing the solution pH value on the adsorption process. Three samples were set with pH value of 3(acidity medium), 7 (neutral medium) and 9 (alkali medium). Samples concentration 50mg/L, volume 50 mL, time was set to 60 mints in shaker and the added adsorbent weight was 1.5gm.

All of the samples resulting from the experiments 2,3 and 4 were then put in the centrifuge for 10 minuts , the supernatant was taken and the absorbance was measured at λmax= 520 nanometer using UV-Vis spectrophotometer (Optima /Japan).

and transfer to the spectrophotometer to measure the absorbance of the samples.

Results and discussion

The first experiment was done to determine the best contact time in the removal of sifranin-O dye from aqueous solutions. The best contact time was reached after 60 minuts which suggested that the new proposed adsorbent can remove the dye fast time and after that it reach saturation and the R% decrease as shown in Table1 and Fig. 1. The obtained results of this study are similar to the results that found by [6].

Table 1: Effect of contact time On the adsorption process

Contact time(minuts)	R%
30	64.96
60	77.57
90	72.44
120	66.86
150	67.74

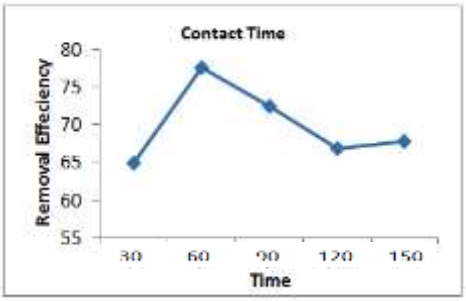

Fig.1: Effect of the contact time on the dye adsorption

The results of the second experiment are shown in Table 2 and Fig. 2 indicate that there was a direct correlation between the increase in the initial dye concentration and the increase in the R% this observation can be explained simply be that the higher dye concentrations means more dye molecules which mean more driving force for adsorption [5]. Adsorbent research will reach saturation and R% then decrease at initial dye concentration of 50 mg /L, and that will decrease the R%, this is similar to the results of [12].

Table 2: Effect of initial dye Concentration on the adsorption process

Initial Dye Concentration(mg/L)	R%
10	50.9
20	52.5
30	51.6
40	54.7
50	49.06

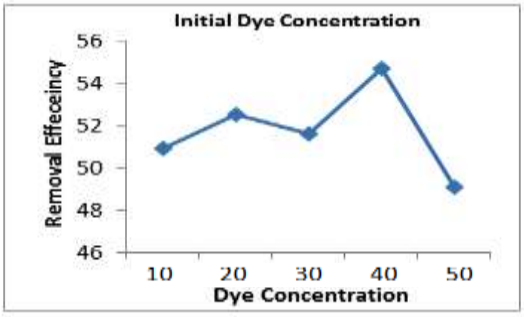

Fig.2: Effect of the Initial Dye Concentration on the adsorption process

Table 3 shows the effects of the adsorbent weight on the adsorption processes, the results show that there was a direct correlation between the increase in the adsorbent weight and the increase in R% and that is due to the increase in the surface area available for adsorption, the results of this study agrees with the finding of [8].

Table 3: Effect of adsorbent dose On the adsorption process

Adsorbent weight(gm)	R%
0.5	37
1	36.58
1.5	42.34
2	52.16
2.5	74.18

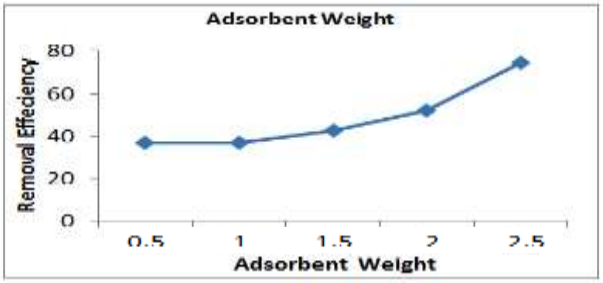

Fig.2: the effect of the Adsorbent on the adsorption process

The results illustrated in Table 4 show that there was a direct correlation between the R% and the increase in pH value, and the results indicates that the removal of sifranin-O increase in alkali medium and that can be due to the fact that anionic dye removal will increase in the alkali medium[8], our results are similar to the results of [7].

Table 4: Effect of pH Value on the adsorption process

pH Value	R%
3	48.32
5	55.35
7	56.21
9	83.55

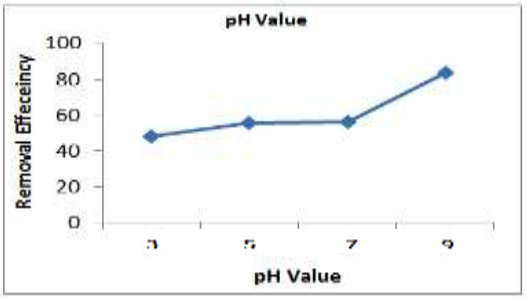

Fig.4: the effect of the pH Value on the adsorption process

Conclusions

The new proposed adsorbent was effective in the removal of the Sifranin-O dye, and the efficiency of the removal increase with the increase of the pH value to alkalinity.

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