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REMOVING OF THYMOL BLUE FROM AQUEOUS SOLUTIONS BY POMEGRANATE PEEL.

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Abstract:-
In this study the pomegranate peel were used to removal of thymol blue from its aqueous solutions, after activation at 500 ºC. Different concentrations of thymol blue used. Different parameters were applied including (effect of dose, effect of adsorption time, effect of pH value).The extent of dye removal increased with increase contact time. An acidic pH is suitable for increased adsorption of dye. The Langmuir isotherm was calculated at the optimum conditions. According to Langmuir isotherm, the mono layer saturation capacity (qm) is 5.28 mg/g. The study concluded that the activated pomegranate peel gone fruitful adsorption results to removal of thymol blue and it could be recommended to using it in other studies of adsorption

Keywords:-*Pomegranate peel, Thymol Blue and aqueous solutions.*

INTRODUCTION

Waste water from textile industry is a serious pollution problem because it is high in both color and organic content. Among textile effluents, synthetic dyes are hardly eliminated under aerobic conditions and are probably decomposed into carcinogenic aromatic amines under anaerobic conditions **[1]** Also, it is difficult to remove reactive dyes using chemical coagulation due to the dyes´ high solubility in water **[2]**. The adsorption process has been found to be versatile as it can remove both inorganic and organic and is an economical and effective treatment method for removal of dyes due to its sludge free clean operation. The removal of color by various low cost, nonconventional adsorbents has been reviewed **[3].** The use of agro/industrial waste residues for the adsorption of dyes has a highlighted as an effective and alternative materials for dye removal **[4].** Activated carbon has widely used for removal of inorganic and organic EPH - International Journal of Applied Science | ISSN: 2208-2182pollutants from aqueous solutions. Various lignocellulosic materials or agriculture wastes such as coconut shell, rice husks, saw dust and wheat straw were used **[5]**.Activated carbon (powdered or granular) is the most widely used adsorbent because it has excellent adsorption efficiency for organic compounds and heavy metals, but its use is somewhat limited due to its high cost which led to search for low-cost adsorbents or preparation of low-cost activated carbon **[6]**. Pomegranate peel activated carbon (PPAC) also used as a new adsorbent for removal of a synthetic dye from aqueous solutions **[7].**

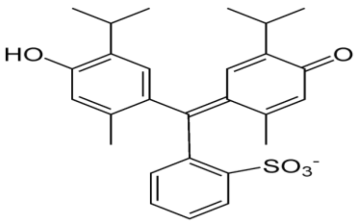
MATERIALS AND METHODS

Preparation of activated carbon

Pomegranate peel was washed with water then dried in an oven at 110 ºC for 90h, milled then burned in an oven at 500 ºC for two hours.

Dye solution preparation

Thymol blue was used as adsorbate. A stock solution of 300 ppm was prepared by dissolving appropriate amount of thymol blue in 500 ml of distilled water. Fig. 1 displays the structure of the thymol blue. Different concentrations ranged from 100 to 115 mg L^{-1} of dye were prepared from stock solution and used to have the standard curve using a UVVIS spectrophotometer (Type D-U 800) at maximum wavelength of 433 nm. All the adsorption experiments were carried out at room temperature.



4-[9-(4-hydroxy-2-methyl-5-propan-2-yl-phenyl)-7,7-dioxo-8-oxa-7λ6-thiabicyclo[4.3.0]nona-1,3,5trien-9-yl]- 5-methyl-2-propan-2-yl-phenol Fig (1) : Structure of the thymol blue .

Adsorption studies

Study of dosage effect:

Adsorption experiments were carried out in 100 ml flasks by agitating different weight of adsorbent from 0.1-0.5 g with 20 ml of 115 mg/L concentration of dye in rotary shaker for 30 min. then they were filtered. Absorbance of dye solution recorded on UV-VIS spectrometer. The percentage removal of dye was calculated using the allowing relationship:

$$Removal\ \% = \frac{C_o - C_e}{C_o} \times 100 \qquad (1)$$

$$Amount\ adsorbed\ (q_e) = \frac{(C_o - C_e)}{m} \times v \qquad (2)$$

q_e amount of dye in mg per gram of adsorbent. Co and Ce are the initial and equilibrium concentration of adsorbate (here, thymol blue dye) respectively, **V** is the volume of dye solution (in liter), **m** is weight of adsorbent

Study of pH effect:

It is well known that the pH of the aqueous solution is an important controlling parameter in the adsorption process **[8, 9].** The pH effect was studied by performing the experiments at different values of pH from 3 to 8. The pH adjusted by universal solution of pH 2 and measured by the pH meter. The adsorbent dosage and initial concentration of dye were fixed.

Adsorption Isotherms:

Adsorption isotherms can be generated based on theoretical principles. .Langmuir isotherm equations have been tested in the present research, in order to describe the equilibrium characteristics of adsorption**.** The most widely isotherm equation for modeling the equilibrium is the Langmuir equation **[10]** which is, valid for monolayer sorption on to a surface of adsorbent is given by equation (3)

$$\frac{Ce}{qe} = \frac{1}{kl} + \left(\frac{al}{kl}\right)Ce \qquad \mathbf{(3)}$$

K_L and a_L are the Langmuir constants related to adsorption capacity and rate of adsorption, respectively which are calculated from slope and intercept of the plot Ce versus Ce⁄qe.
The essential characteristics of Langmuir adsorption isotherm can be expressed in terms of a dimensionless constant, separation factor or equilibrium parameter 'RL' which is defined by,

$$R = \frac{1}{1 + al.Ci} \qquad (4)$$

Where, Ci = initial concentration of the dye and al=Langmuir constant. RL>1 Unfavorable, RL=1 Linear, 0<RL<1 Favorable, RL=0 Irreversible

RESULTS AND DISCUSSION

Effect of Adsorbent Dose:

According to the removal percentage (%) results for the effect of doses on the adsorption of Thymol blue , It seems that the dose of 0.1 g of carbon pomegranate peel gave the highest percentage (48.7 %) followed by 0.2 g (47.1 %). On the other side the lowest percentage value (44.8, 45.3and 43.3) were recorded for doses (0.3, 0.4 and 0.5). These results shown in Fig (2).The amount adsorbed calculated too, and the results shown in Fig (3).

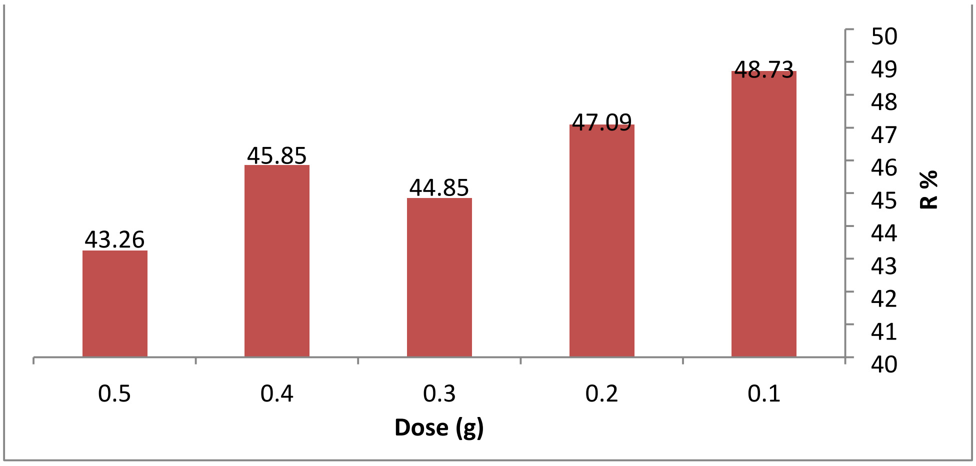


Fig (2): Removal Percentage of thymol blue by using different doses of adsorbent.

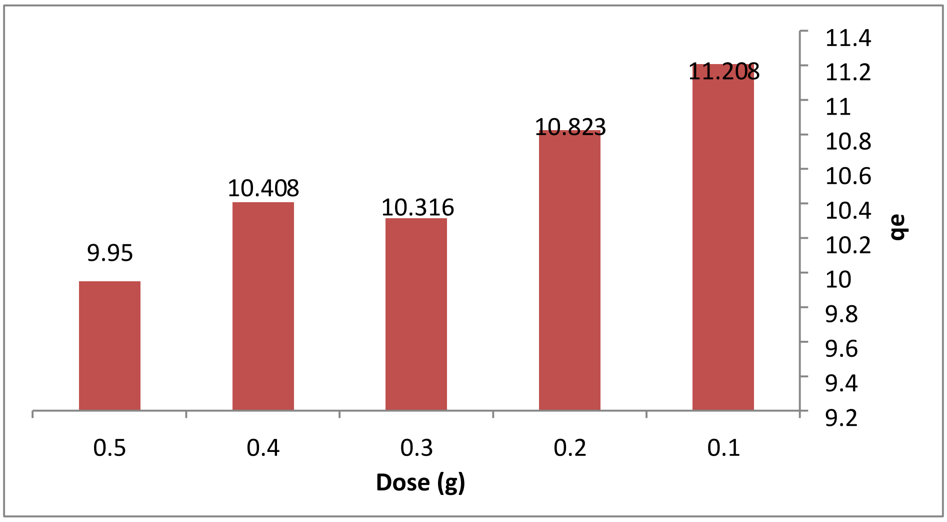


Figure (3): the relationships between qe and doses.

Effect of reaction time:

The effect of reaction time on the overall thymol blue removed was studied by withdrawal of samples at an interval of 10 minutes. The total duration of the runs was 50 minutes. The results are plotted in Figure (4). It can be seen that 51% removal of dye occurred in 50 minutes. The amount of dye adsorbed on the activated carbon at each time period was calculated and plotted in Fig (5).

Effect of pH on the adsorption:

The results are presented in Fig (6), It can be seen that dye removal was maximum at pH 6 and showed 56.8% reduction from the initial concentration. After this value the removal percent decreased. The maximum affinity of this dye could be at acidic pH values. The q_e values calculated and plotted in Fig (7).

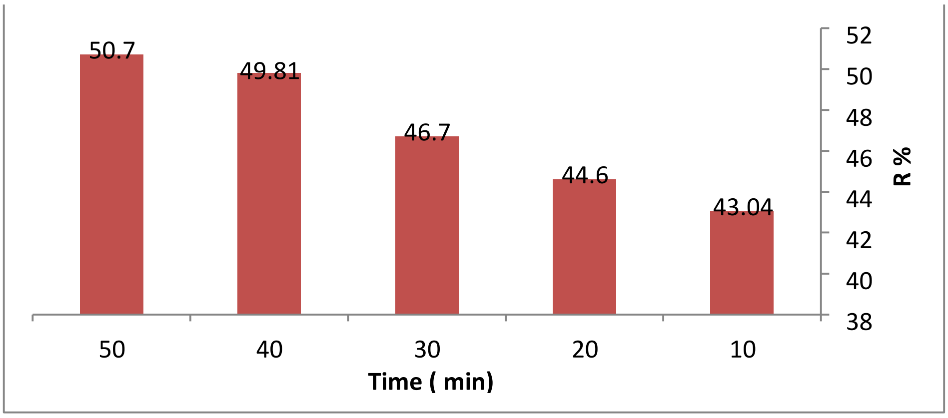


Fig (4): Effect of time reaction on the removal of dye

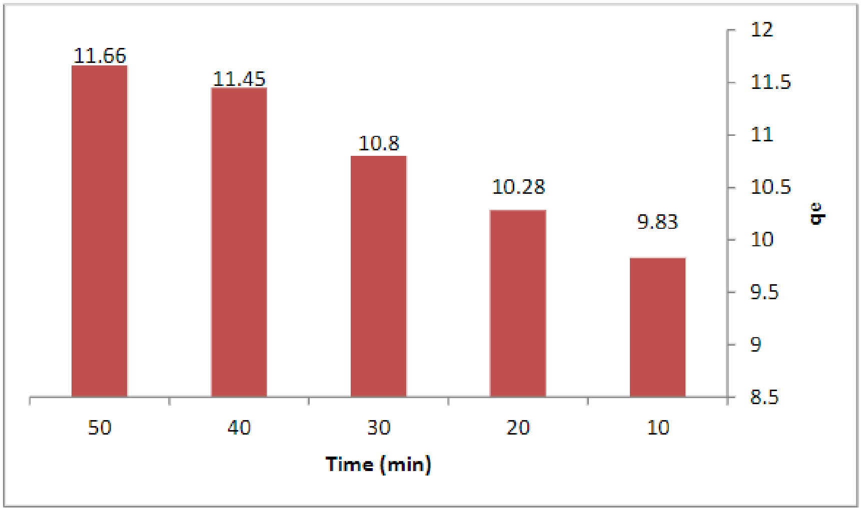


Fig (5): Relationship between adsorption time and amount adsorbed.

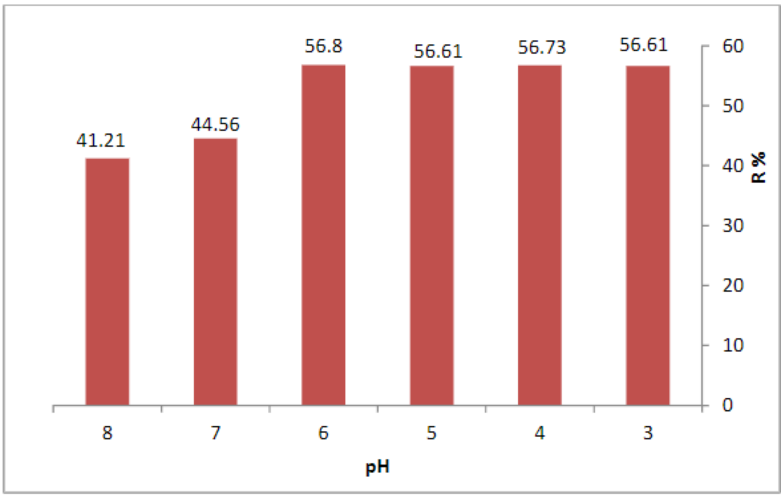


Fig (6): Effect of pH value on the adsorption of thymol blue.

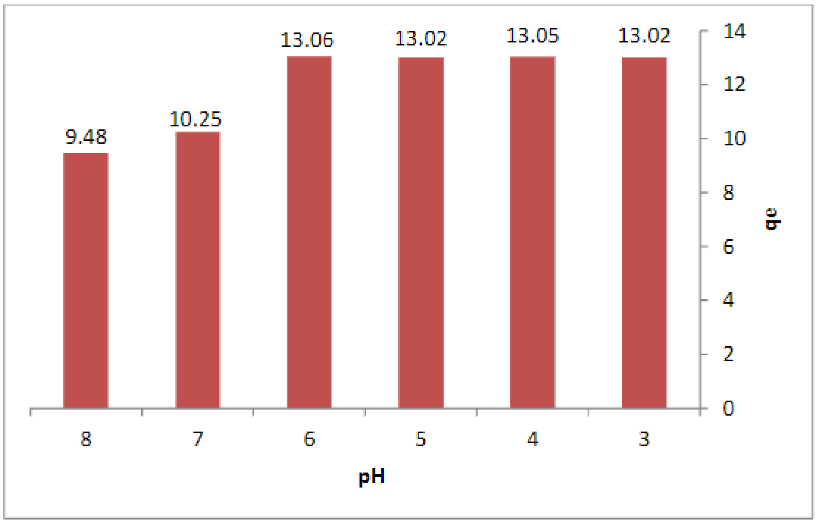


Fig (7): Relationship between q_e and pH

Adsorption isotherm:
The adsorption capacity and other parameters were evaluated using Langmuir, isotherm model. It has been observed that the sorption capacity (q_m) was found to be 5.28 mg/g (Table 1). The high value of correlation coefficient (0.997) indicates the applicability of Langmuir isotherm which assumes a monolayer coverage and uniform activity distribution on the sorbent surface. In the present study, R_L values ($0 < R_L < 1$) favor the adsorption of thymol blue onto pomegranate peel activated carbon (Table 1).

Table 1. Results of Langmuir isotherm plots for the adsorption of thymol blue on PPAC

Model	Isotherm constants			
Langmuir	q_m (mg /g)	K_L (L/mg)	R_L	R^2
	5.28	0.169	0.35	0.995

CONCLUSION
The present study aimed to remove the thymol blue from aqueous solutions. The present study showed that the PPAC is an affective and inexpensive adsorbent for removal of thymol blue from aqueous solution. In this study, PPAC shows promising adsorption capacity for thymol blue removal .The operating parameters for the maximum sorption were sorbent dosage (0.1 g/l), contact time (50 min). Removal of thymol blue dye is pH dependent and the maximum removal was attained at pH 6. Equilibrium data were fitted well in the Langmuir model, which confirmed that the sorption is heterogeneous and occurred through physico–chemical interactions.

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