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A STUDY ON REMOVAL OF DYE GREEN B FROM AQUEOUS SOLUTION USING SAW DUST AS AN ADSORBENT

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ABSTRACT

The removal of vast amount of colors in water produces genuine Environmental issues. Numerous textile enterprises dependably utilize colors and shades to shading their item. Shading expulsion textile profluent is a noteworthy natural issue. The hued gushing inhibitory affect the procedures of photosynthesis which are irritating sea-going biological community. Color Green B is chosen since it isn't effectively degradable and is dangerous in nature. The impact of various parameters like pH,, contact time, adsorbent portion, and temperature were contemplated.

The Freundlich and Langmuir adsorption isotherm were considered. The measure of adsorption increments with expanding adsorption portion, contact time p^H and temperature. The ultrasonic speed of the color arrangement was additionally examined. The outcome demonstrated that, the speed increments with adsorption. The dynamic examination demonstrates that pseudo second request show is more fitted than pseudo first request display. This impact is seen because of swelling of the structure of the adsorbent which empowers expansive number of color atoms adsorbed on adsorbent body.

The outcome demonstrated that 80%dye was expelled when pH is 9 and contact time is 120 minutes. At the point when the temperature increments from 298K to 308K the adsorption limit likewise increments.

KEYWORDS: *adsorption, adsorption isotherms, adsorption kinetics,dye,Dye Green B,Saw dust.*

INTRODUCTION

Textile ventures dependably utilize colors and shades to shading their items. Shading expulsion from textile profluent is a noteworthy natural problem.(Namasivayam C et al., 1993) Many colors and their separate items are poisonous for living creatures (Nigam P et al.,2000)and in this manner influencing amphibian biological community. Colors tend to create metal particles in textile water produces smaller scale danger in the life of fish. There are numerous physical and compound techniques for the expulsion of colors like co-angulation, precipitation, filtration, oxidation, and amassing. In any case, these techniques are not generally utilized because of their staggering expense. Adsorption strategy (Sarioglu M. et al., 2006) is the best adaptable technique over every single other treatment. In this way the proposed work will attempt utilizing horticulture squander like corncob for expelling color textile (Singh B.K. et al., 1994) (Mckay G et al., 1986) (Khare S.K. et al., 1987) (Joung R.S. et al., 1977) from watery arrangement.

MATERIAL AND METHODS:

Saw dustwas washed with distilled water and dried in an oven at 120^{0} C. It was then sievedthrough sieve no. 100 (150µm). The BET surface area of Saw dustwas 41.m^2/gm. obtained from BET technique. Dye Green B used was from finer chemicals Ltd.

The X-ray diffraction study of saw B dust was carried out by X-ray Fluorescence Spectrometer (Philip model PW 2400) as shown in (figure1).The morphological and XRD study clearly indicates that the adsorbent is porous and amorphous in nature.

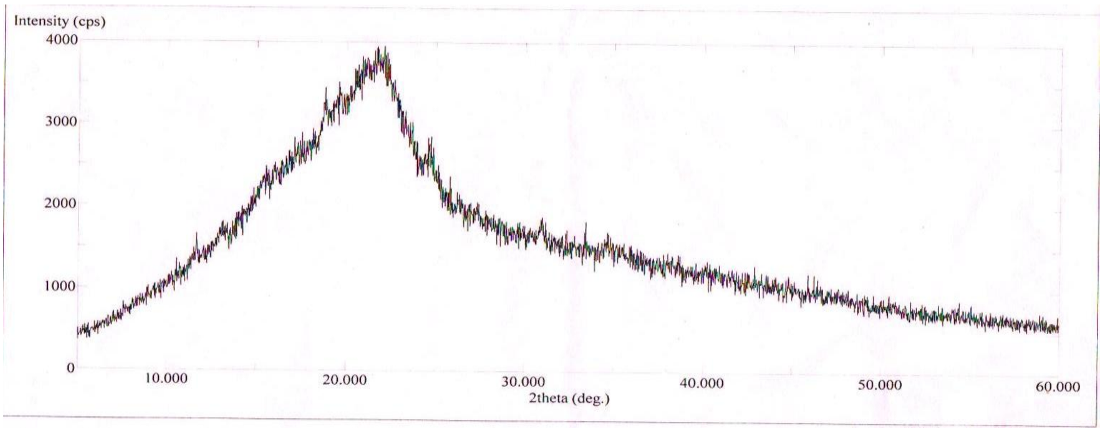

Figure 1: X-ray diffraction pattern of Saw dust

The IR spectrum of Saw dust was also studied as shown in (figure 2).

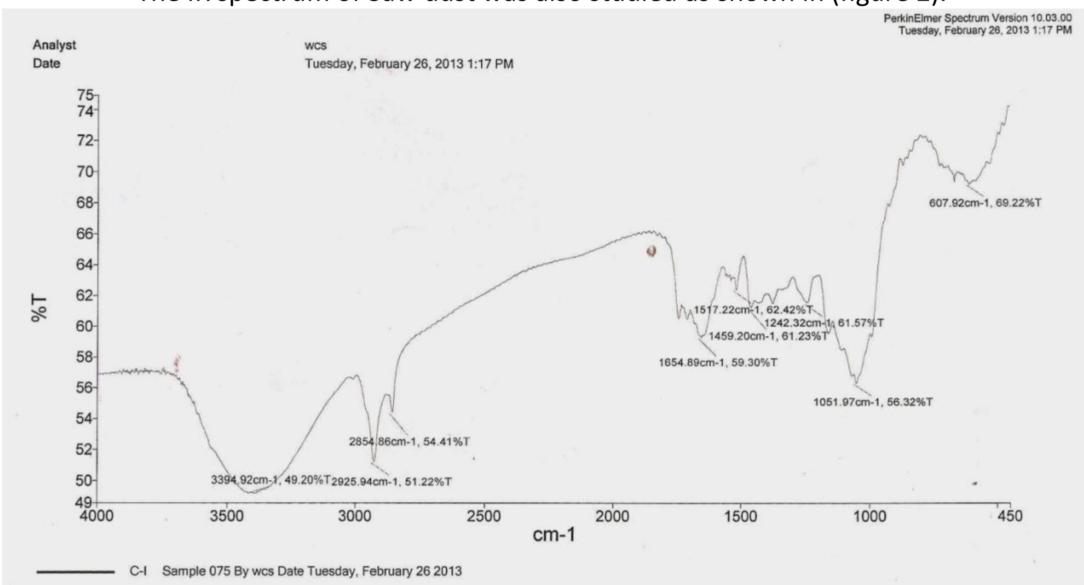

Figure 2 :IR spectrum of Saw dust

From the **SEM** analysis it was found that there were holes and cave type openings on the surface of adsorbent which would have more surface area available for adsorption (Khatri S.D. *et al.*, 1999) as shown in(figure 3)

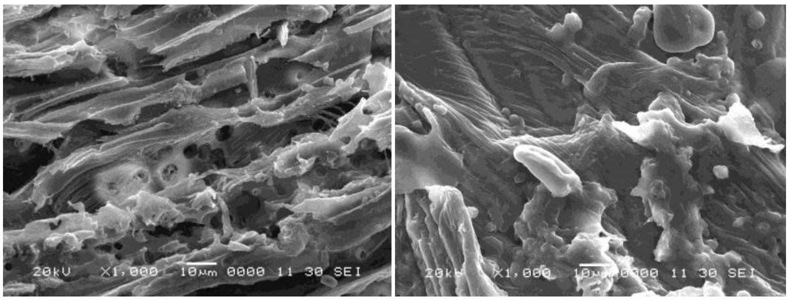

Figure 3
(Before adsorption) (After adsorption)
Scanning electron micrograph (SEM) of theSaw dust adsorbent

EXPERIMENTAL PROCEDURE:

Group adsorption tests were directed by shaking 150 ml of color arrangement having fixation (50 mg/l) i.e. 50 ppm with various measure of adsorbent and having diverse pH esteems, at various temperatures and in addition distinctive time interims. The adsorbent was then evacuated by filtration and the grouping of color was assessed spectro photograph metrically at λ_{max}= 600 nm. The measure of color adsorbed was then figured by mass equalization relationship condition.

$$q_e = \frac{C_o - C_e}{X}$$

Where,
C_o = Initial dye concentration
C_e = Equilibrium dye concentration
q_e = Amount of dye adsorbed per unit mass of adsorbent.
X = Dose of adsorbent.

RESULTS AND DISCUSSIONS:

For getting highest amount of dye removal various factors were optimized.

EFFECT OF CONTACT TIME:

With the end goal to know least measure of adsorbent for the evacuation of most extreme measure of color, the contact time was upgraded. The outcomes demonstrated that the degree of adsorption is quick at the underlying stage following 120 minutes the rate of adsorption is consistent. About 80% color was expelled. (Figure 4)

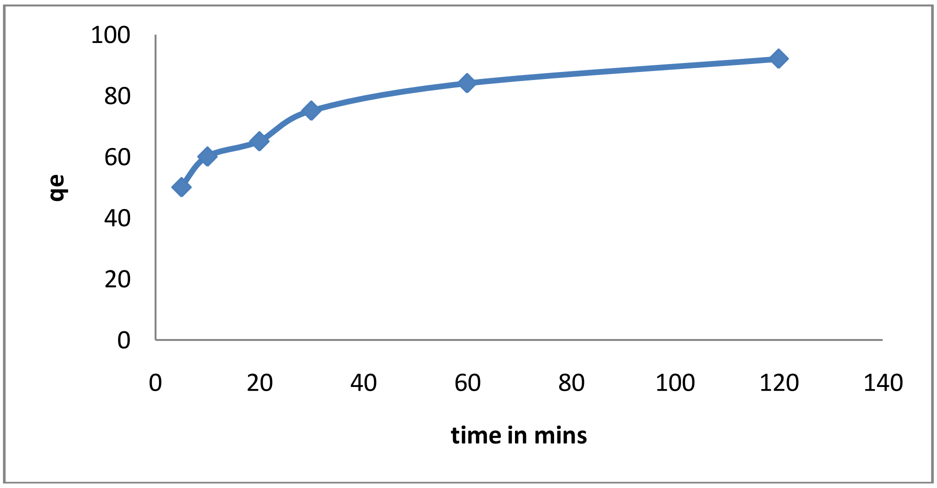

Figure 4 Effect of contact time on removal of Malachite green by saw dust

Effect of p^H:

From (figure 5), it uncovers that when p^H of the color arrangement increments from 3 to 9 the level of color expulsion additionally increments. At p^H= 9, adsorption is greatest. By further increment in pH adsorption diminishes somewhat. (Nimkar D.A.*et al.*, 2014)

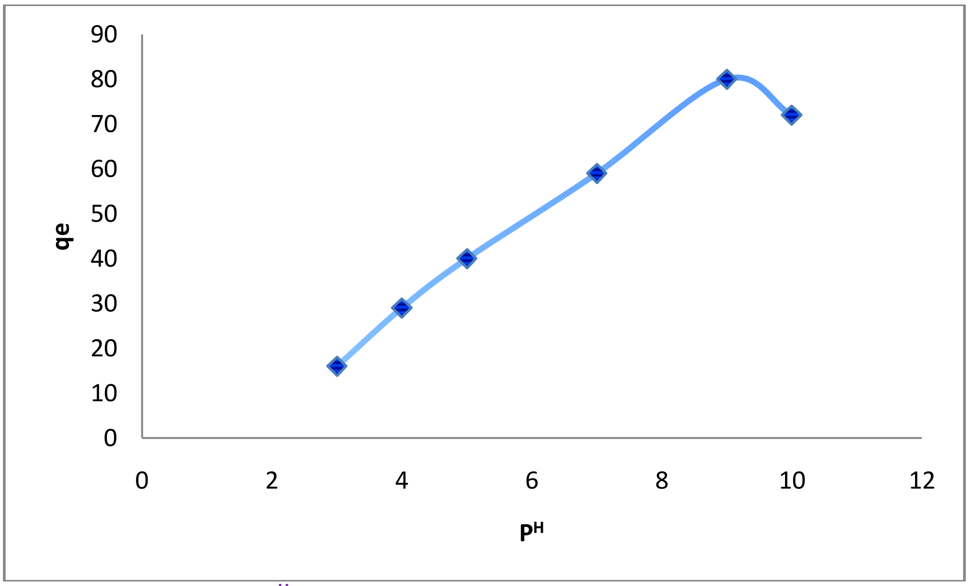

Figure 5 Effect of p^Hon removal of Malachite green by saw dust.

EFFECT OF ADSORBENT DOSE:

The distinctive adsorbent dosages were examined from the range 0.5gm to 7.0 gm from the outcomes, unmistakably the ideal portion is 1gm/150ml. (Figure 6). By further increment of adsorbent portion, the expulsion of adsorbent reductions because of a portion of the adsorption destinations stays unsaturated amid the process(Ferro. F et al., 2008) (Bhatt R. et al., 2011) (Theng B.K.G. et al., 1955) (Garg V.K. et al., 2004)

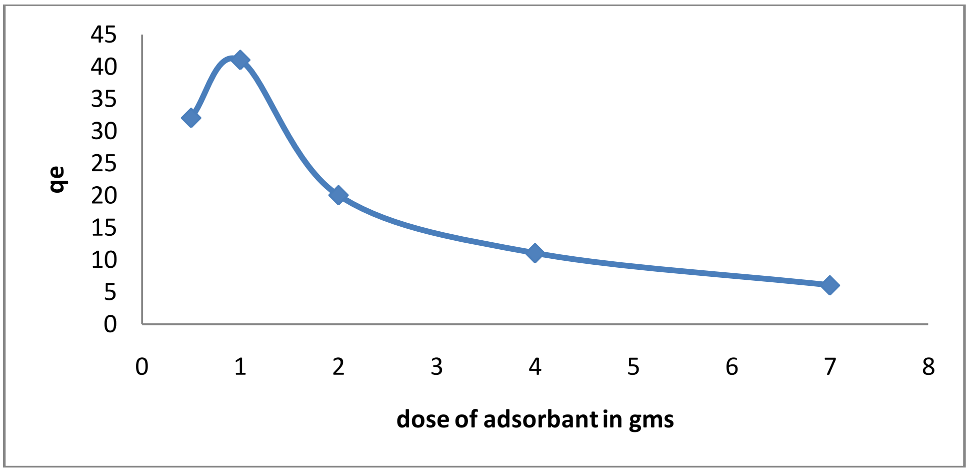

Figure 6 Effect of adsorbent doseon removal of Malachite green by saw dust

EFFECT OF TEMPERATURE:

The scrutiny of (figure 7) obviously adsorption limit of adsorbent increments with increment in temperature, because of increment in the portability of color particles. Expanding temperature additionally causes a swelling impact inside the interior structure of adsorbent. With the goal that substantial number of color particles can without much of a stretch enter through it (Yamin Y*et al*., 2007) (Mane R.S. *et al*., 2012)

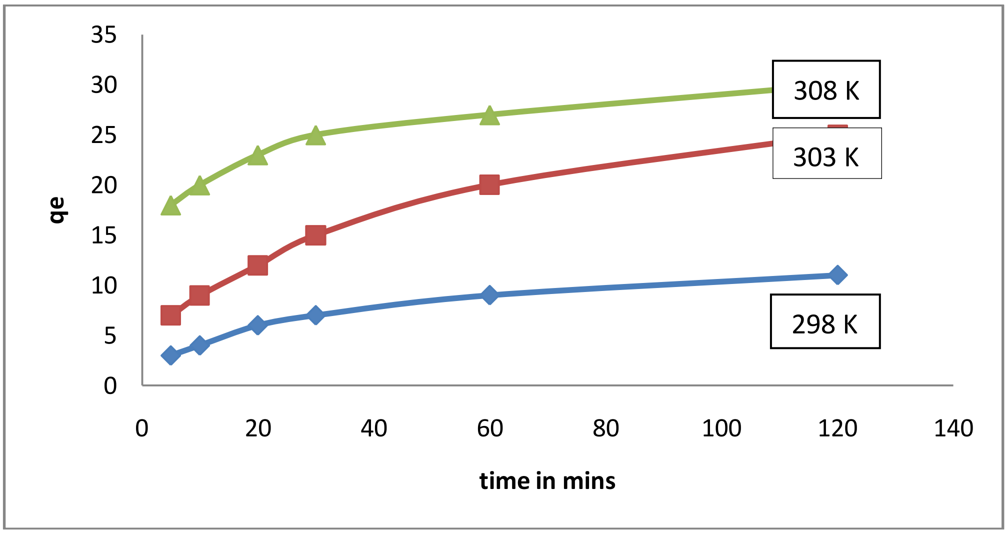

Figure 7 Effect of contact timeon removal of Malachite green by saw dust

Adsorption Isotherm:

Langmuir Isotherm:

In order to study the adsorption of dye according to Langmuir isotherm, following equation was used

$$\frac{C_e}{q_e} = \frac{1}{Q_m \times b} \times \frac{C_e}{Q_m}$$

Where
C_e =Dye concentration at equilibrium (mg/ L)
q_e =Amount of dye adsorbed on the adsorbent (mg/g)
b =Langmuir constant
A graph of C_e/ q_e against C_e was plotted as shown in (figure 8)

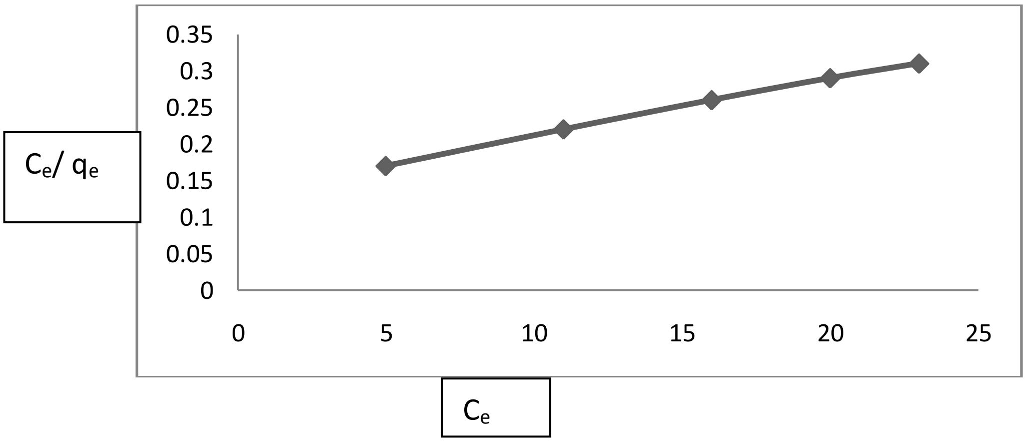

Figure 8 Langmuir Isotherm for adsorption of Malachite green on saw dust.

The connection factor is firmly identified with solidarity, which shows that the Langmuir isotherm display is pertinent (Sen A.K. et al., 1987) (Mallipudi S.et al., 2013) (Parvathi C.et al., 2009). The arrangement of monolayer happens on the surface of the adsorbent (Arivoli S.et al., 2007) (Thievarasu C. et al., 2011)

Freundlich isotherm:

To study the Freundlichisotherm the following equation was used. (Karabulut S. *et al*., 2000)

$$\log \quad q_e = \log \quad K_f + \log \frac{C_e}{n}$$

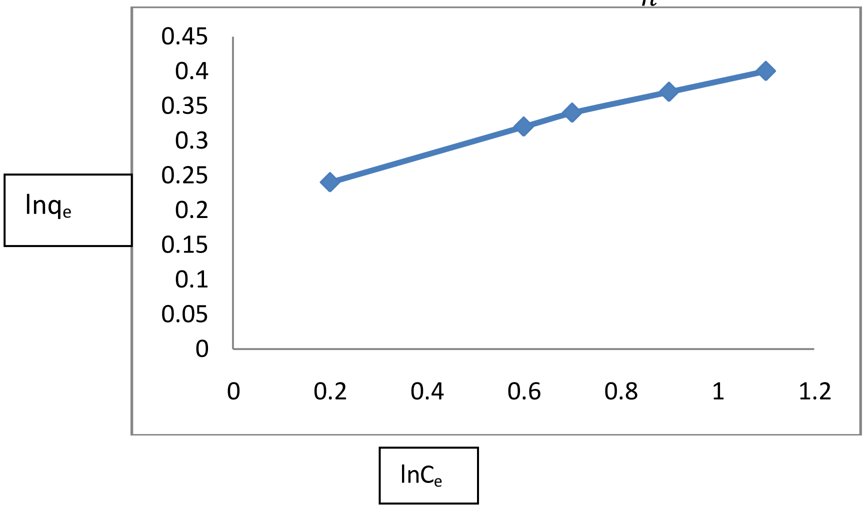

Figure 9 Freundlich Isotherm of Malachite green on saw dust.

The chart of $\ln q_e$ against $\ln C_e$ was plotted. From the incline, the estimation of n and connection factor can be figured. The estimation of relationship factor is firmly identified with one as appeared in (figure 9) So it demonstrates that the Freundlich isotherm additionally fulfilled. The estimation of n is more prominent than 1. So the Freundlich adsorption grows fittingly.

Adsorption kinetics:

Pseudo 1^{st} order model:

The pseudo 1^{st} order kinetics model is used to understand the kinetic behavior of the system(Paul S. A. *et al*., 2011) (Nagada G. k. *et al*., 2007)(Sarioglu M. *et al*.,2006) It is given by the equation.

$$\frac{dq}{dt} = k_i\,(q_e - q_t)$$

A graph of $\ln(q_e - q_t)$ vs time was plotted as shown in (figure 10)

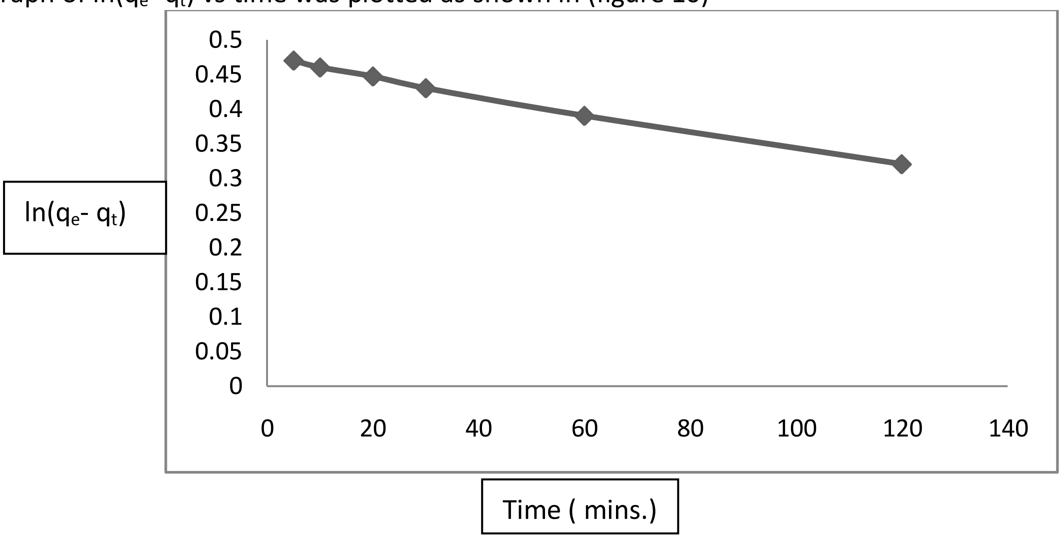

Figure 10 Plot of pseudo 1^{st} order for adsorption of Malachite green on saw dust.

Table no.1

Slope (K_i) (correlation coefficient)	Intercept (q_e) (Max. adsorption capacity)	Correlation Factor
-0.00129	0.45	-0.92

Pseudo 2nd order kinetics:

The pseudo 2nd order kinetic model was studied using equation

$$\frac{t}{q_e} = \frac{q^2{}_e}{k_2} + \frac{t}{q_e}$$

Where q_e = dye adsorbed at equilibrium.
q_t = dye adsorbed at time t
A graph $t/q_t$of against time was plotted as shown in (figure 11)

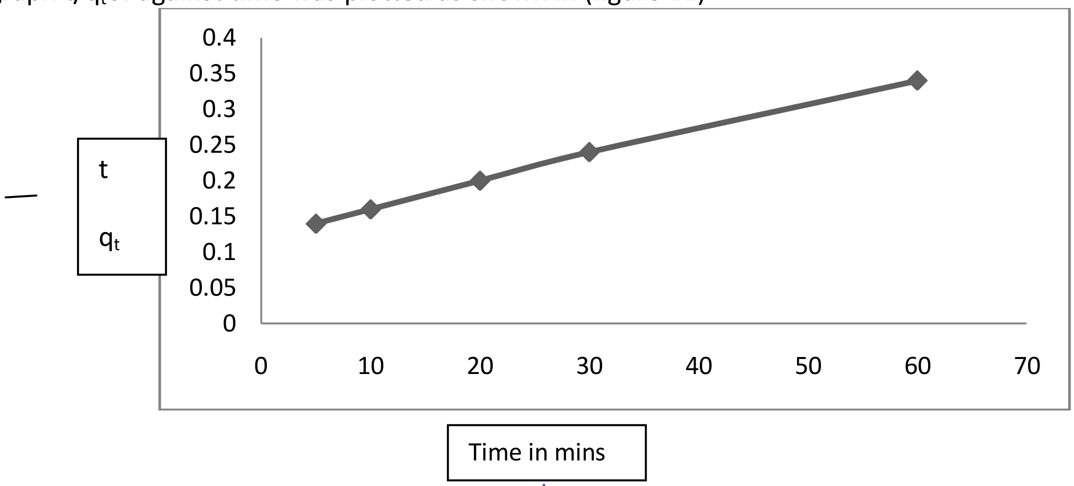

Figure 11 Plot of pseudo 2nd order of Malachite green on saw dust.

Slope (K_2)	Intercept (q_e)	Correlation factor
0.00353	0.127	0.99

Table no 2

If there should be an occurrence of pseudo first request dynamic model,(Table no.1) the estimation of slant and connection factor are negative. While if there should arise an occurrence of pseudo second request dynamic model,(Table no 2)the estimation of incline and relationship factors are sure. Which suggests that, the framework is more ideal for pseudo second request energy.

CONCLUSION:

Saw dust goes about as a superior successful ease adsorbent for the expulsion of Basic Green. Clump adsorption was demonstrated that yield of adsorption increments by expanding adsorbent portion, contact time,p^H,and temperature.The wellness of Langmuir display demonstrates that there is a development of mono-layer on the adsorbent surfaces. Likewise Freundlich isotherm additionally grow properly.

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REFERENCES:

1. Arivoli S., Hema N., "Comparative study on the adsorption kinetics and thermo dynamics of dyes on the activated low cast carbon" Int. J. Phys. Sci. 2 (2007): 10-17.
2. Bhatt R., Parve Z. M., Jr.of chemical society of Pakistan 33(2001) 502.
3. Ferro F., Journal of Hazardous Textile 142 (2007) 144.
4. Garg V. K., Kumar Rakesh, Gupta Renuka,waste Dyes and pigments 63 (2004) 243-250.
5. Juang R. S., Wu F. C., Tsang R. L., Environ. Technol. 18 (1997) 525-531.
6. Karabulut S. Sep. purif. Tech. 18 (2000) 177-187.
7. Khare S. K., Panday K. K., Srivastava R. M., Singh V. N.,J. Chem. Technol, Biotechnol. 38 (1987) 99-104.
8. Khatri S. D., Singh M. K., Ind. Chem. Technol. 6 (1999) 112-116.
9. Mallipudi S., et al. International Journal of Engineering Research and Technology, 2(10) (Oct-2002) 4054-4059.
10. Mane R. S., Bhusari V. N., IJERA 2(3), (June2001),1997-2004.
11. McKay G., Prasad G. R., Mowli P. R., Water Air Soil Pollut. 29 (1986) 273-283.
12. Nagada G. K., Diwan A. M., Ghole V. S., App. Eco and Environ. Res. 2 (2007) 1.
13. Namasivayam C. and Kanchanna N., Peranika J.Sci.and Technol. 1(1) (1993) 33-42
14. Nigam P., Armour G., Singh D., Merchant R., Bioresour Technol 72 (2000) 219-226.
15. Parvathi C. Sivamani S., Prakash C. Colourage Environmental solution. LV I 10 (Oct 2009) 54-56.
16. Paul S. A., Chavan S. K., Oriental J. Chem. 27 (2001) 47-51.
17. Sarioglu M., Atay U.. global nest Journal 8(2) (2006) 113-120.
18. Sen A. K. and De. A. K., Water Res. 21 (1987) 885.
19. Singh B. K., Rawat N. S., J. Chem. Technol. Biotechnol. 61 (1994) 307-317.
20. Theng B. K. G., Wells N., Appl. Clay. Sci. 9 (1995) 321-326.
21. Thievarasu C., Mylsamy S. and Sivakumar N., Universal Journal of Env. Research and Tech. 1 (2005) 70-78.
22. Yamin Yasin, Mohd. Zobir Hussein, Faujan Hj Ahmad, Malaysian Journal of analytical sciences. 11 (2007) 400-406.