ISSN: 2249-894X IMPACT FACTOR : 5.2331(UIF) VOLUME - 6 | ISSUE - 12 | SEPTEMBER - 2017

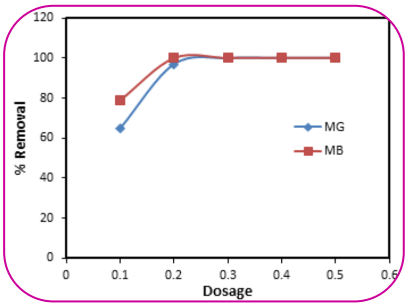
REVIEW OF RESEARCH

REMOVAL OF GREEN-B DYE USING SAW DUSTAS AN ADSORBENT

Nimkar D. A.
P. G. Department of Chemistry, D. B. F. Dayanand College of Arts and Science,
Solapur (Maharashtra), India.

ABSTRACT

Presently *multi day's material industry produces intense ecological issue. Numerous material ventures dependably utilize colors and shades to shading their item. Shading expulsion material profluent is a noteworthy ecological issue. The shaded emanating inhibitoryaffects the procedures of photosynthesis which are irritating vegetation. It additionally creates issues on human life. For this investigation Dye Green B (color) is chosen since it isn't effectively degradable and is poisonous in nature. The impact of various parameters like* p^H*,contact time, adsorbent portion, and temperature were examined.*



The Freundlich and Langmuir adsorption isotherm were examined. The measure of adsorption increments with expanding adsorption portion, contact time, p^H *and temperature. The ultrasonic speed of the color arrangement was additionally considered. The outcome demonstrated that, the speed increments with adsorption. The motor examination demonstrates that pseudo second request display is more appropriate than pseudo first request show. This impact is seen because of swelling of the structure of the adsorbent which empowers huge number of color atoms adsorbed on adsorbent body.*
The outcome demonstrated that 80% color was expelled when pH is 8 and contact time is 110 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

The removal ofColor from textile effluent is a major environmental problem.(Namasivayam C*et al*., 1993) Many dyes and their break down products are toxic for living organisms (Nigam P *et al*.,2000)and thus affecting aquatic ecosystem. Dyes have a tendency to produce metal ions in textile water produces micro toxicity in the life of fish. There are many physical and chemical methods for the removal of dyes like co-angulation, precipitation, filtration, oxidation, and flocculation. But these methods are not widely used due to their high cost. Adsorption technique (Sarioglu M.*et al*., 2006) is the best versatile method over all other treatments. Therefore the proposed work will undertake using agriculture waste like saw dust forremoving dye material(Singh B.K. *et al*., 1994) (Mckay G *et al*., 1986) (Khare S.K. *et al*., 1987) (Joung R.S. *et al*., 1977) from aqueous solution.

MATERIALS 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 42.m^2/gm. obtained from BET technique. Dye Green B used was from finer chemicals Ltd.

The X-ray diffraction study of saw dustwas 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.

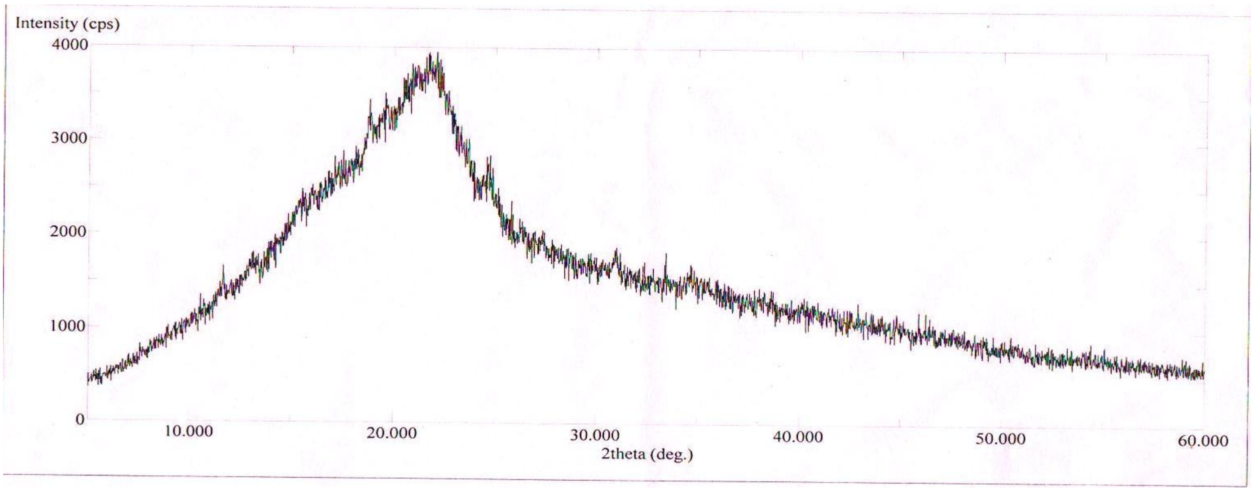


Figure 1: X-ray diffraction pattern of saw dust

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

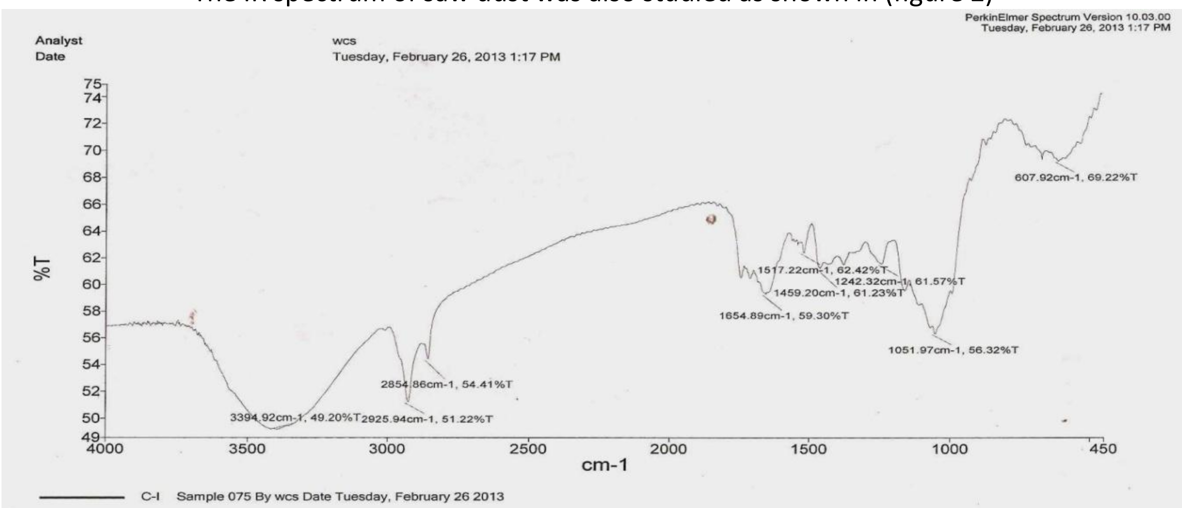


Figure 2: IR spectrum of saw dust

From the **SEM** analysis it was found that there were number of pores 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)

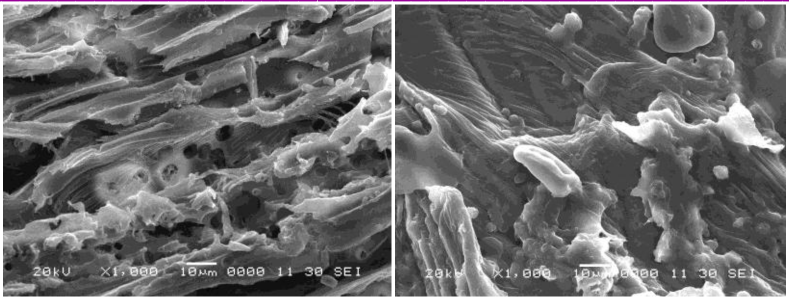


Figure 3
(Before adsorption)(After adsorption)
Scanning electron micrograph (SEM) of thesaw dustadsorbent

Experimental Procedure:

Bunch adsorption tests were led by shaking 200 ml of color arrangement having fixation (50mg/l) i.e. 50 ppm with various measure of adsorbent and having diverse pH esteems, at various temperatures and also unique time interims. The adsorbent was then expelled by filtration and the convergence of color was evaluated spectro photometrically at λ_{max}= 580 nm. The measure of color adsorbed was then computed by mass parity 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:

To know least measure of adsorbent for the evacuation of most extreme measure of color, the contact time was streamlined. The outcomes demonstrated that the degree of adsorption is quick at the underlying stage following 110 minutes the rate of adsorption is steady. About 85% color was expelled. (Figure 4)

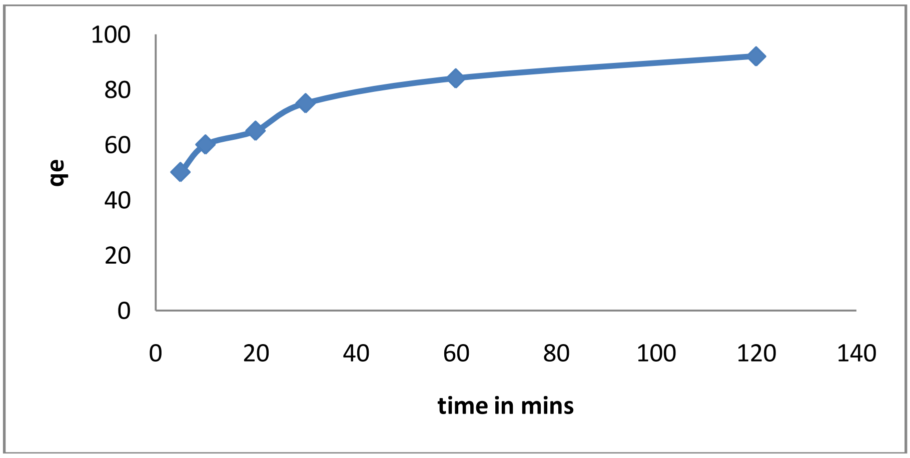


Figure 4 Effect of contact time on removal of Green –B dye by saw dust

Effect of p^H:

From (figure 5), it reveals that when p^H of the dye solution increases from 3 to 10 the percentage of dye removal also increases. At p^H= 10, adsorption is maximum, by further increase in p^H adsorption decreases slightly. (Nimkar D.A.*et al.*, 2014)

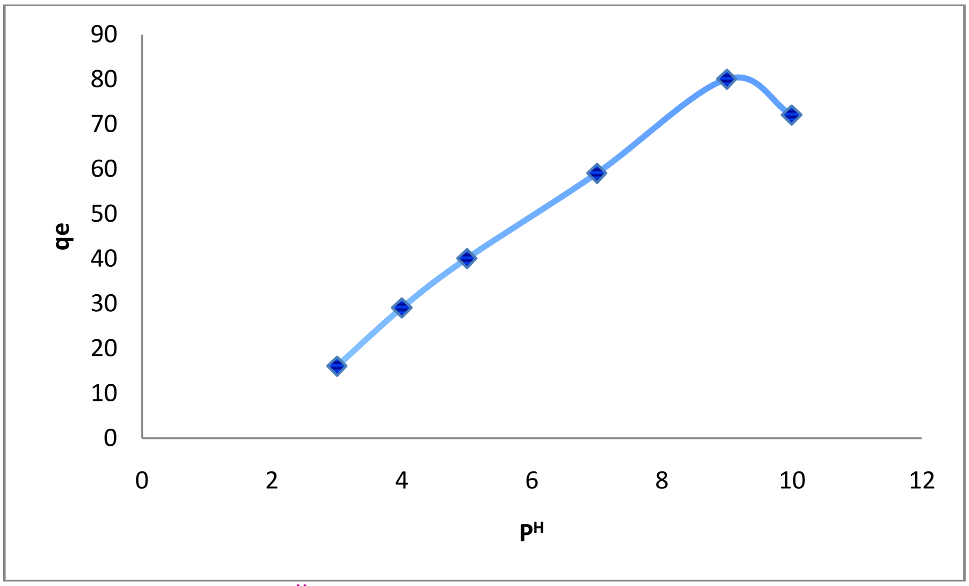


Figure 5 Effect of p^Hon removal of Green –B dye by saw dust

Effect of adsorbent dose:

The different adsorbent doses were studied from the range 0.5gm to 7.0 gm from the results, it is clear that the optimum dose is 1gm/150ml. (Figure 6). By further increase of adsorbent dose, the removal of adsorbent decreases due to some of the adsorption sites remains unsaturated during 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)

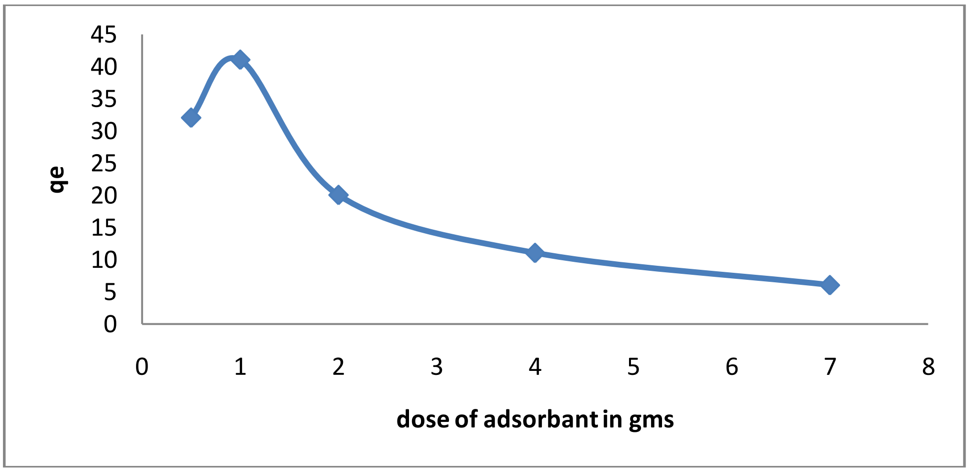


Figure 6 Effect of adsorbent doseon removal of Green – B dye by saw dust

Effect of temperature:

The examination of (figure 7) it is clears that adsorption limit of adsorbent increments with increment in temperature, because of increment in the versatility of color particles. Expanding temperature likewise causes a swelling impact inside the inward structure of adsorbent. So expansive number of color atoms can without much of a stretch infiltrate through it (Yamin Y*et al*., 2007) (Mane R.S. *et al*., 2012)

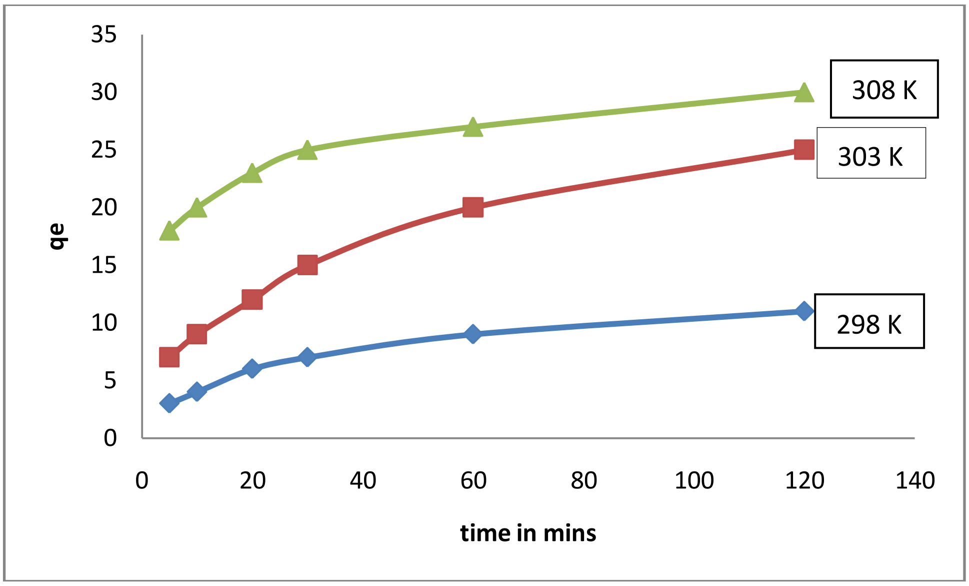


Figure 7 Effect of contact timeon removal of Green – B dye using saw dust

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)

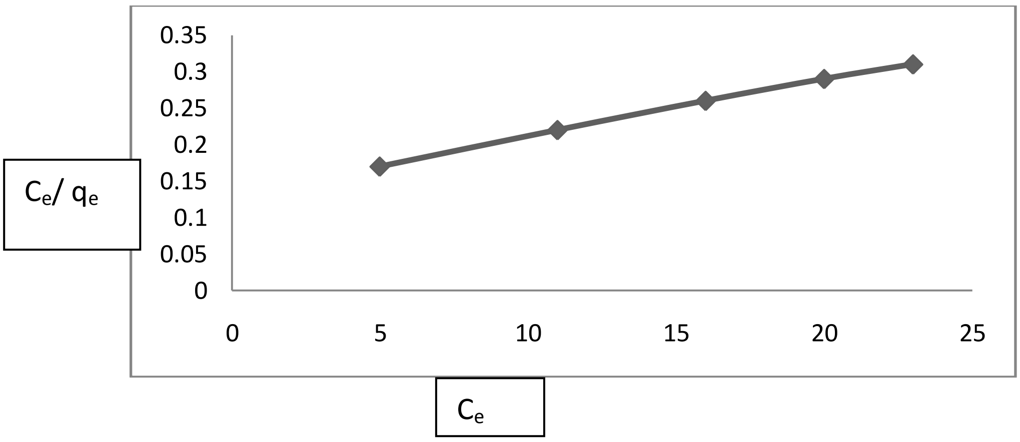


Figure 8 Langmuir Isotherm for adsorption of Green- B dye on saw dust

The correlation factor is closely related to unity, which indicates that the Langmuir isotherm model is applicable(Sen A.K. *et al.*, 1987) (Mallipudi S.*et al.*, 2013) (Parvathi C.*et al.*, 2009). The formation of monolayer takes place 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)

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

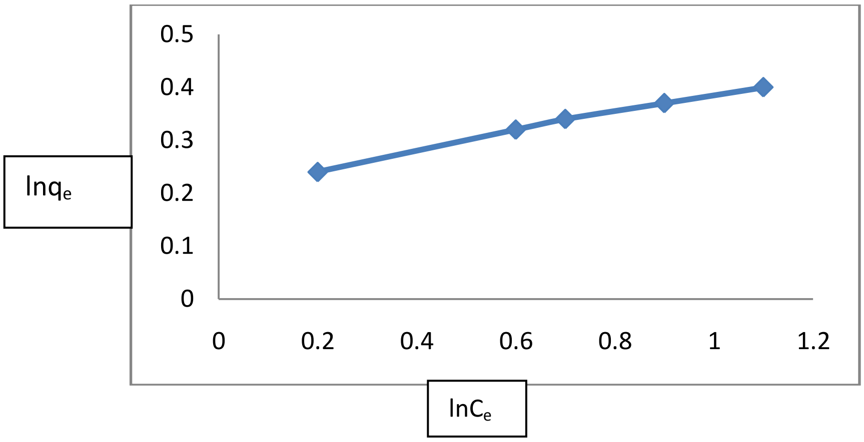


Figure 9 Freundlich Isotherm of Green – B dye onsaw dust

The graph of $\ln q_e$ against $\ln C_e$was plotted. From the slope, the value of n and correlation factor can be calculated. The value of correlation factor is closely related to one as shown in(figure 9) So it indicates that the Freundlich isotherm also satisfied. The value of n is greater than 1. So the Freundlich adsorption develops appropriately.

Adsorption kinetics:

Pseudo 1st order model:

The pseudo 1st 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)

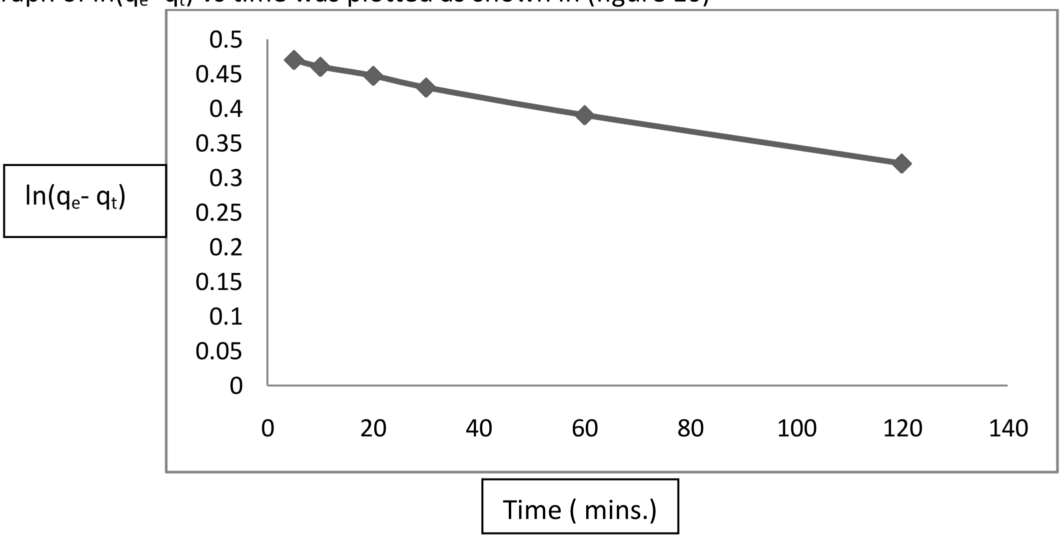


Figure 10 Plot of pseudo 1st order for adsorption of Green – B dye on saw dust.

Table no.1

Slope (K_i) (correlation coefficient)	Intercept (q_e) (Max. adsorption capacity)	Correlation Factor
-0.00120	0.40	-0.88

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)

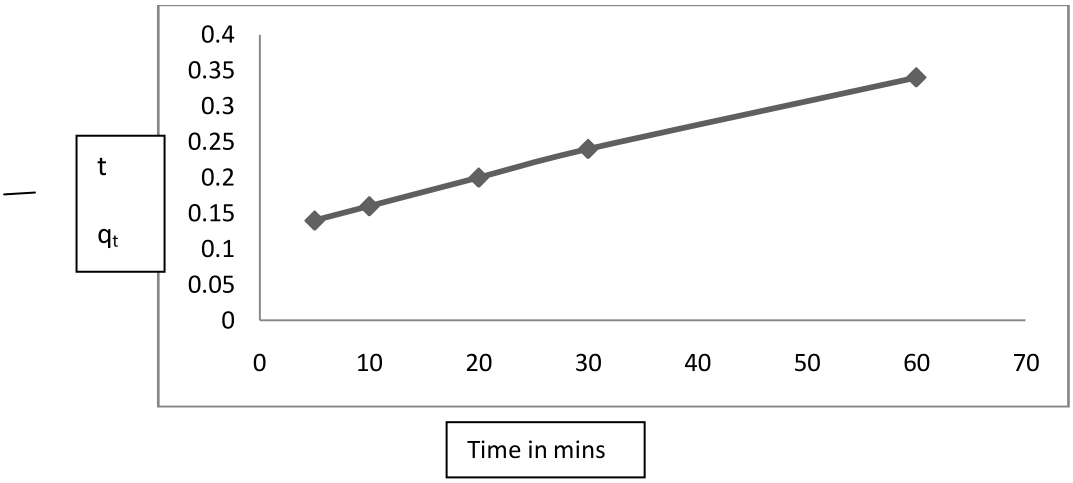


Figure 11 Plot of pseudo 2nd order of Green – B dye on fly ash

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

Table no 2

In case of pseudo 1st order kinetic model,(Table no.1) the value of slope and correlation factor are negative. While in case of pseudo 2nd order kinetic model,(Table no 2)the value of slope and correlation factors are positive. Which implies that, the system is more fevourable for pseudo 2nd order kinetics.

CONCLUSION:

Saw dust acts as a best effective low cost adsorbent for the removal of Basic Green – B dye .Batch adsorption was shown that yield of adsorption increases by increasing adsorbent dose, contact time,p^H,and temperature.The fittness of Langmuir model shows that there is a formation of monolayer on the adsorbent surfaces. Similarly Freundlich isotherm also develop appropriety.

ACKNOWLEDGEMENT

Authers are thankful for the financial support to University Grants Commission Western Regional office Ganesh khind, Pune, India under Minor Research Project [File no-47-140/12(WRO)]

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 Material 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.