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REMOVAL OF COLOUR DYE USING BAGASSE FLY ASH AS AN ADSORBENT

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ABSTRACT

The arrival of extensive amounts of colors in to water by material businesses produces intense natural issue. Numerous material enterprises dependably utilize colors and shades to color their item. Color expulsion material profluent is a noteworthy natural issue. The shaded profluent inhibitory affect the procedures of photo-synthesis which are exasperating sea-going biological community. For this examination Dye Green B (color) is chosen since it isn't effortlessly degradable and is harmful in nature. The impact of various parameters like p^H, contact time, adsorbent portion, and temperature were considered.

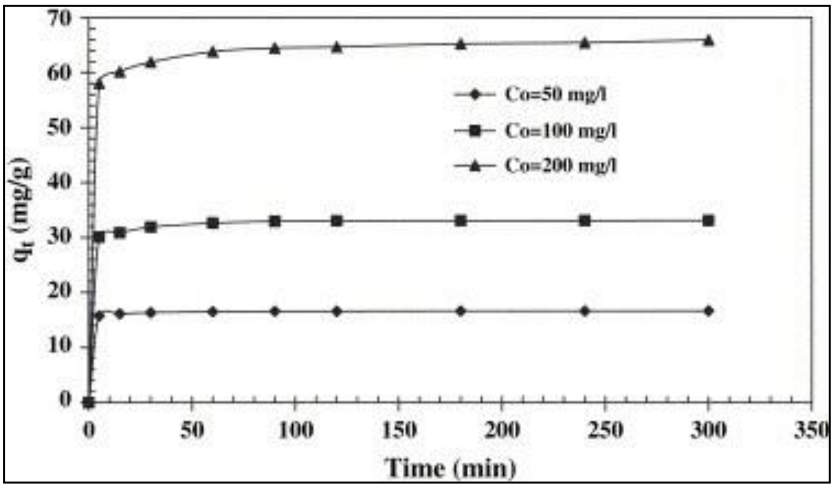
The Freundlich and Langmuir adsorption isotherm were examined. The measure of adsorption increments with expanding adsorption portion, contact time, p^H and temperature. The ultrasonic speed of the color arrangement was likewise considered. The outcome demonstrated that, the speed increments with adsorption.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

The outcome demonstrated that 85% color was evacuated when p^H is 9 and contact time is 120 minutes. At the point when the temperature increments from 298K to 308K the adsorption limit additionally increments.

KEYWORDS:
adsorption, adsorption isotherms, adsorption kinetics , dye,Dye Green B,fly ash.

INTRODUCTION

Color expulsion from material profluent is a noteworthy natural problem.(Namasivayam C et al., 1993) Many colors and their separate items are poisonous for living beings (Nigam P et al.,2000)and consequently influencing sea-going biological system. Colors tend to create metal particles in material water produces miniaturized scale poisonous quality in the life of fish. There are numerous physical and substance techniques for the evacuation of colors like co-angulation, precipitation, filtration, oxidation, and flocculation. Be that as it may, these techniques are not broadly utilized because of their surprising expense. Adsorption strategy (Sarioglu M. et al., 2006) is the best flexible technique over every other treatment.



Consequently the proposed work will embrace utilizing agribusiness squander like corncob for expelling color 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 fluid arrangement.

MATERIALS AND METHODS:

Fly fiery remains was washed with refined water and dried in a broiler at 1200 C. It was then sieved through strainer no. 100 (150µm). The BET surface region of Saw dust was 42.m2/gm. gotten from BET system. Color Green B utilized was from better synthetics Ltd.

The X-ray diffraction investigation of fly fiery debris was completed by X-ray Fluorescence Spectrometer (Philip demonstrate PW 2400) as appeared in (figure1).The morphological and XRD think about obviously shows that the adsorbent is permeable and nebulous in nature.

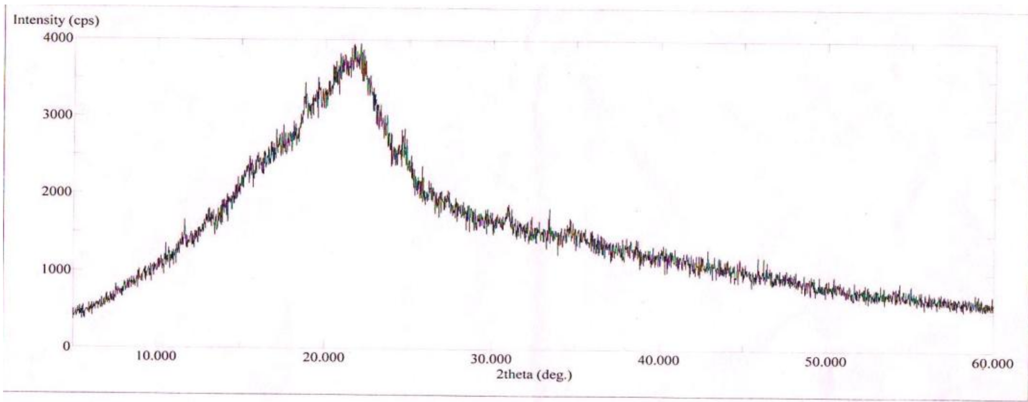


Figure 1: X-ray diffraction pattern of Fly ash

The IR spectrum of fly ash was also studied as shown in (figure 2).

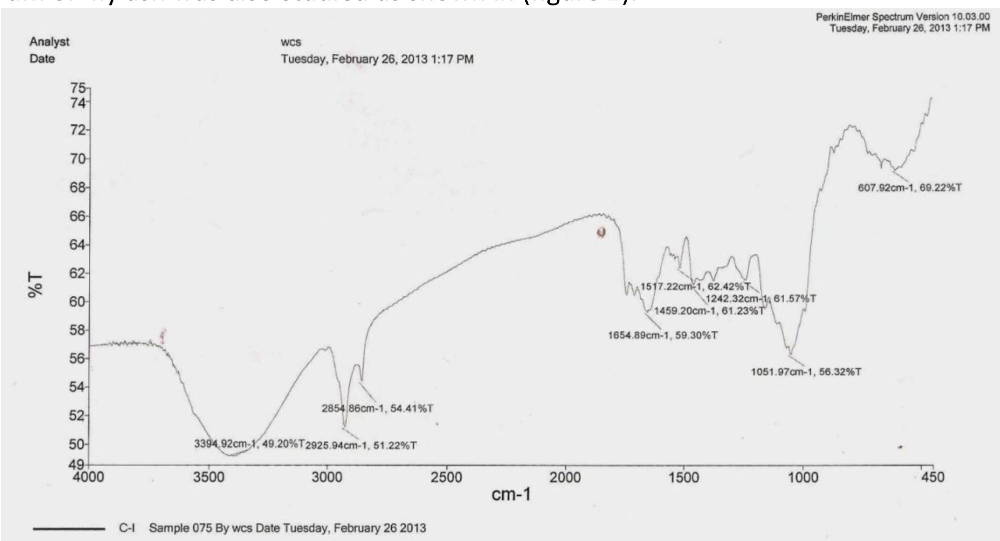


Figure 2 :IR spectrum of Fly ash

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)

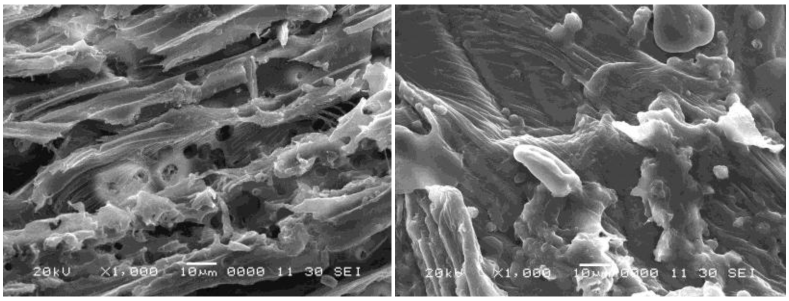


Figure 3

(Before adsorption) (After adsorption)

Scanning electron micrograph (SEM) of theFly ash adsorbent

Experimental Procedure:

Group adsorption tests were led by shaking 200 ml of color arrangement having focus (50mg/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 centralization of color was evaluated spectro photo metrically 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 expulsion of most extreme measure of color, the contact time was improved. 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 evacuated. (Figure 4)

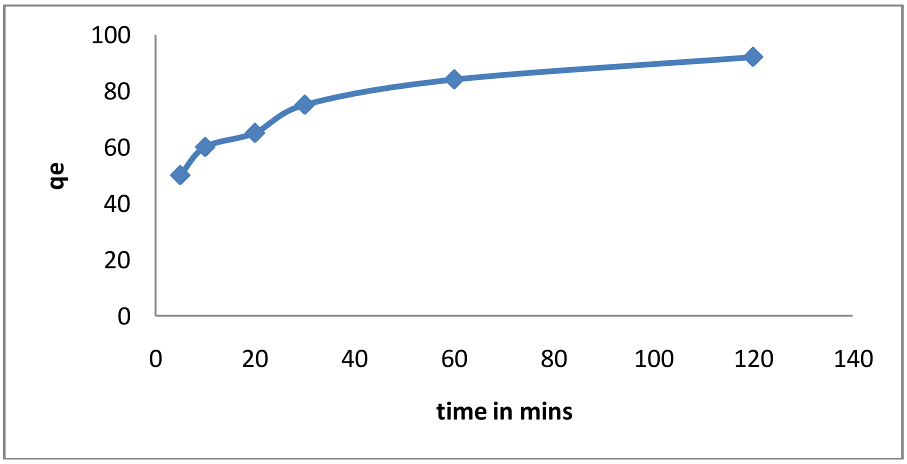


Figure 4 Effect of contact time on removal of Green –B dye by fly ash

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. Byfurther increase in p^H adsorption decreases slightly(Nimkar D.A.*et al.*, 2014)

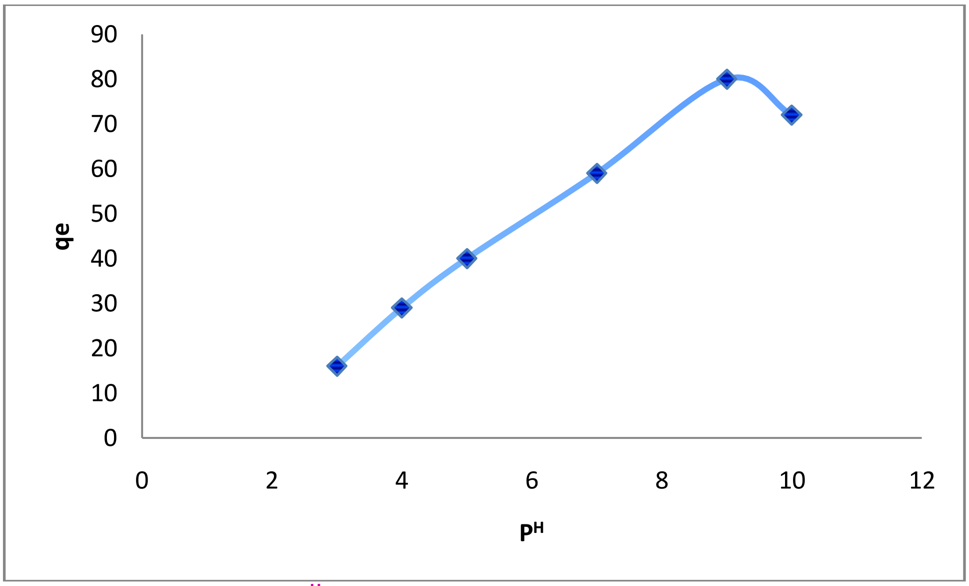


Figure 5 Effect of p^Hon removal of Green –B dye byfly ash.

Effect of adsorbent dose:

The diverse adsorbent portions were considered 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 evacuation of adsorbent declines because of a portion of the adsorption locales stays unsaturated amid the procedure (Ferro. F *et al.*, 2008) (Bhatt R. *et al.*, 2011) (Theng B.K.G. *et al.*, 1955) (Garg V.K. *et al.*, 2004)

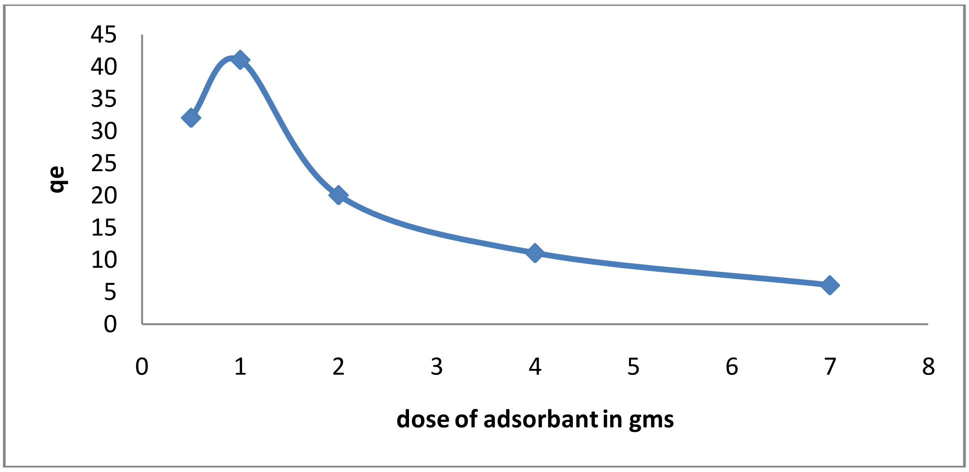


Figure 6 Effect of adsorbent doseon removal of Green – B dye by fly ash.

Effect of temperature:

The scrutiny 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 additionally causes a swelling impact inside the inward structure of adsorbent. So substantial number of color atoms can undoubtedly enter through it (Yamin Y*et al*., 2007) (Mane R.S. *et al*., 2012)

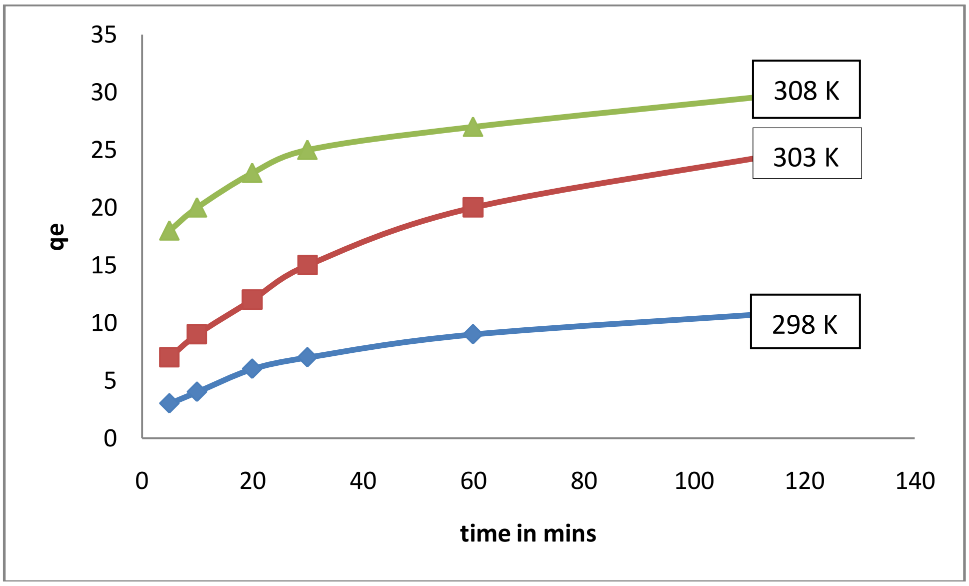


Figure 7 Effect of contact timeon removal of Green – B dye using fly ash

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)

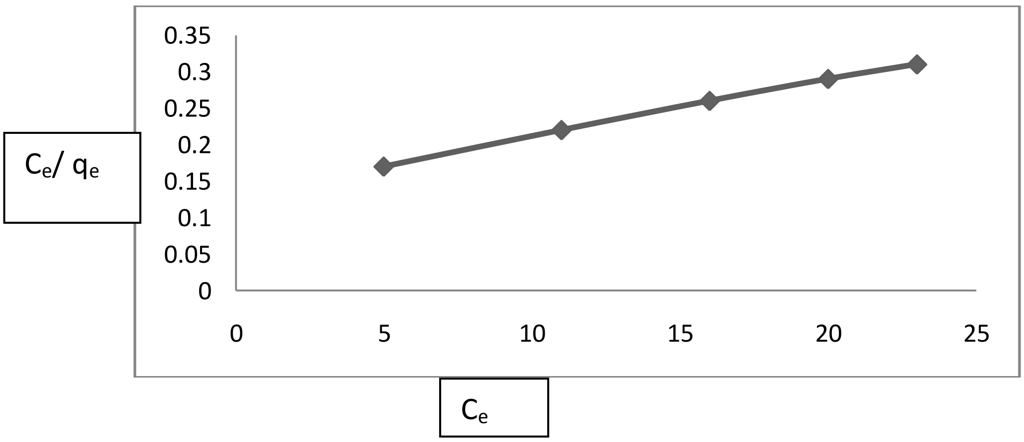


Figure 8 Langmuir Isotherm for adsorption of Green- B dyeon fly ash

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)

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

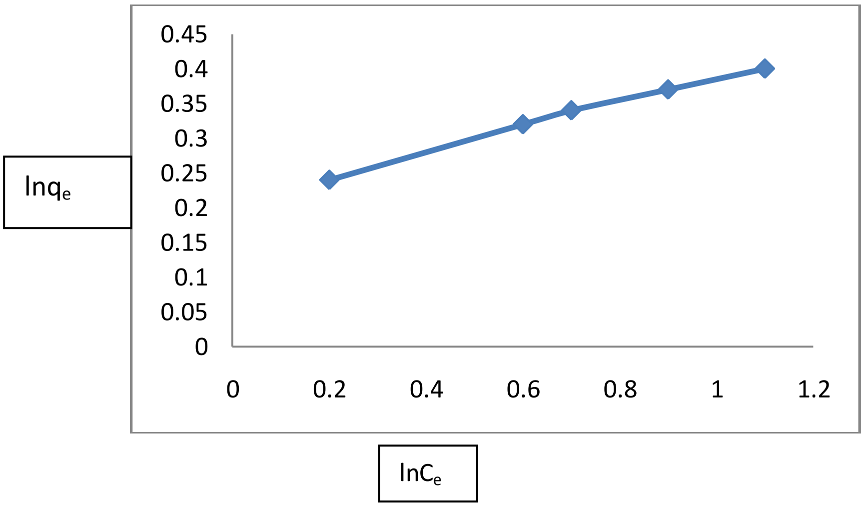


Figure 9 Freundlich Isotherm of Green – B dye onfly ash.

The diagram of $\ln q_e$ against $\ln C_e$ was plotted. From the slant, the estimation of n and connection factor can be computed. The estimation of connection factor is firmly identified with one as appeared in (figure 9) so it shows that the Freundlich isotherm additionally fulfilled. The estimation of n is more prominent than 1. So the Freundlich adsorption grows suitably.

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)

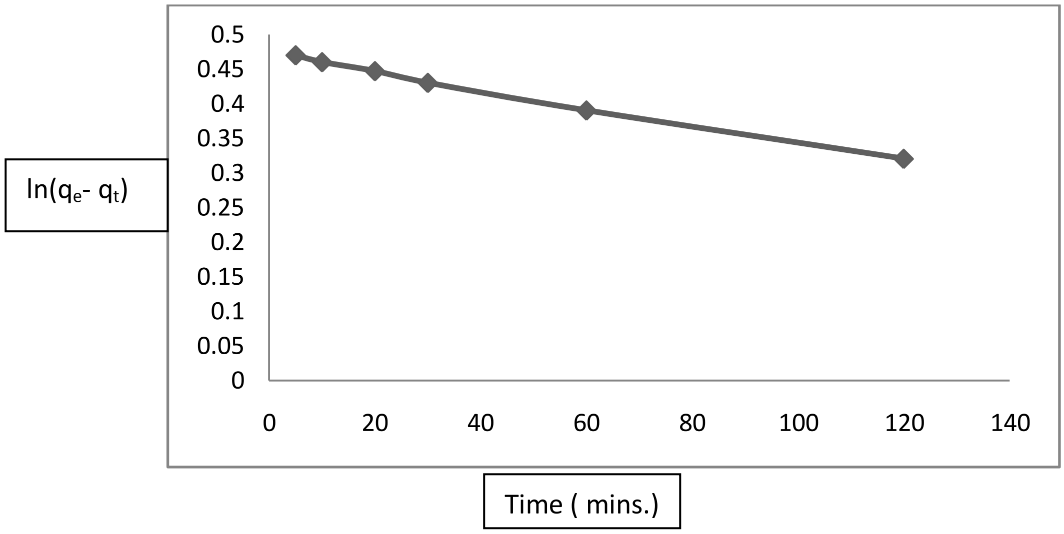


Figure 10 Plot of pseudo 1st order for adsorption of Green – B dye on fly ash.

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)

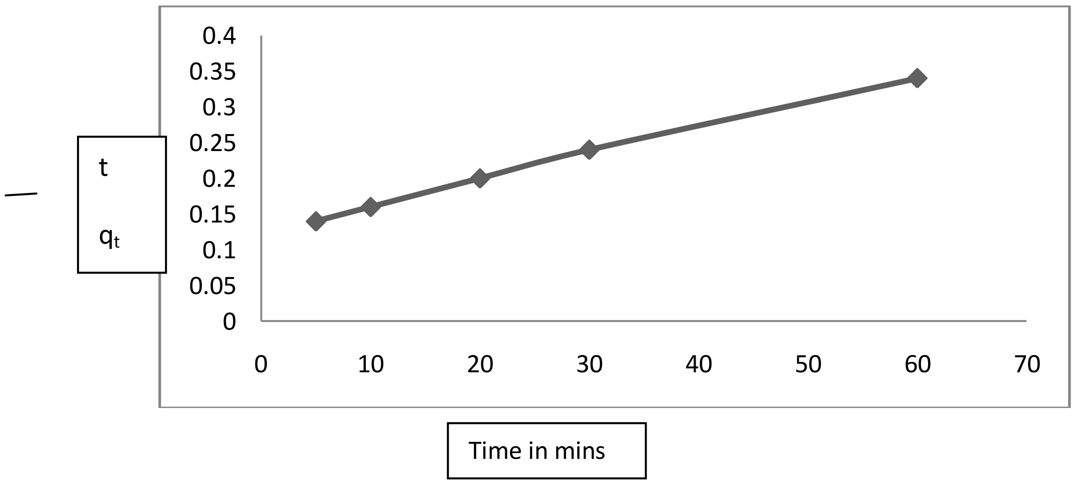


Figure 11 Plot of pseudo 2nd order of Green – B dye on fly ash

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

Table no 2

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

CONCLUSION:

Fly fiery debris goes about as a best compelling minimal effort adsorbent for the evacuation of Basic Green – B color .Batch adsorption was demonstrated that yield of adsorption increments by expanding adsorbent portion, contact time,pH,and temperature.The wellness of Langmuir display demonstrates that there is an arrangement of mono layer on the adsorbent surfaces. Essentially Freundlich isotherm likewise grow fittingly.

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