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COMPARATIVE STUDY OF REMOVAL OF ACID RODAMIN DYE FROM AQUEOUS SOLUTION USING WHEAT STRAWS, ALMOND SHELLAND WALNUT SHELLAS AN ABSORBENTS

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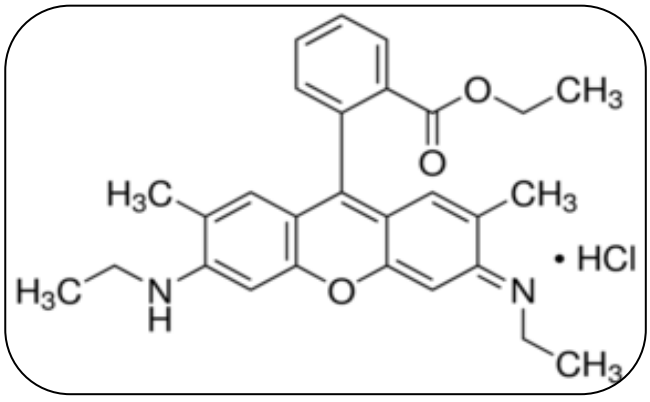
Abstract :

Industries like textile utilize color to shading their items. The nearness of these hued colors in water makes genuine natural issues. The hued emanating is released into adjacent land, waterway or ocean. The nearness of these hued colors in to water even at low focus is unmistakable and hindering.

Acid Rodamine Dye is chosen since it isn't effortlessly 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 contemplated. 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 show is more fitted than pseudo first request display for all the three adsorbents.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 evacuated when p^H is 9.5 and contact time is 125 minutes. At the point when the temperature increments from 298K to 308K the adsorption limit likewise increments. The adsorptive intensity of wheat straws > Almond shell > Walnut shell.

Key Words: *Industries , genuine natural issues , Freundlich and Langmuir adsorption isotherm.*

INTRODUCTION

Acid Rodamine Dye is a harmful color which has by and large been expelled from water tests through regular techniques. The expulsion of shading from material gushing is a noteworthy natural issue. (Namasivayam C et al., 1993) Dyes and their Variety of items are lethal for living life forms (Nigam P et al.,2000)and along these lines influencing ecological biological system. Colors tend to deliver hues in material

water which is valuable in material industry. There are numerous physical and concoction techniques for the evacuation of colors like assimilation, electrolysis, filtration, oxidation, and dialysis. Be that as it may, these techniques are not broadly utilized because of their surprising expense. Adsorption system (Sarioglu M. et al., 2006) is the best flexible strategy over every single other treatment. In this way the proposed work will attempt utilizing agribusiness squander like corncob for evacuating 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.

TEXTILES AND METHODS:

Wheat straws was washed with refined water and dried in a broiler at 1300 C. It was then sieved through sifter no. 100 (150µm). The BET surface territory of Saw dust was 42.m2/gm. gotten from BET procedure. Corrosive Rodamine Dye utilized was from Finer synthetic substances Ltd.

The X-beam diffraction investigation of Wheat straws was done by X-beam Fluorescence Spectrometer (Philip display PW 2400) as appeared in (figure1).The morphological and XRD think about unmistakably shows that the adsorbent is permeable and indistinct in nature.

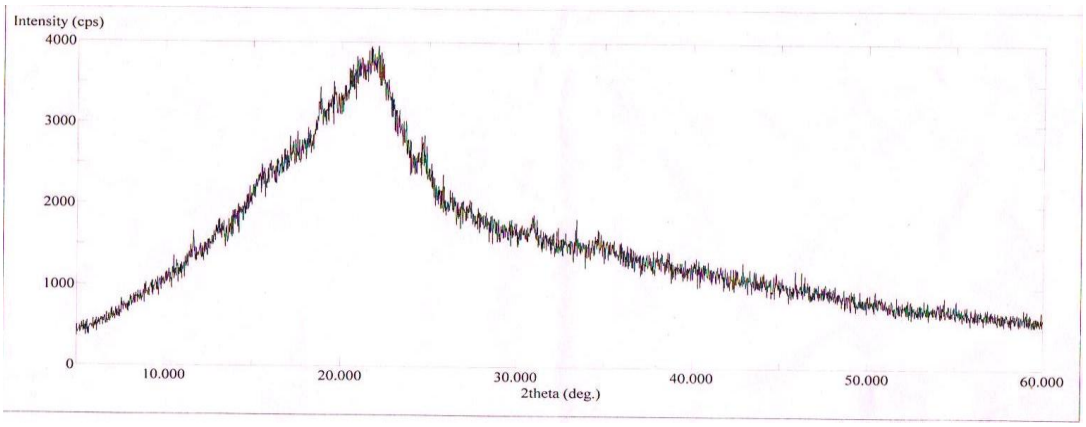


Figure 1: X-ray diffraction pattern of Wheat straws

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

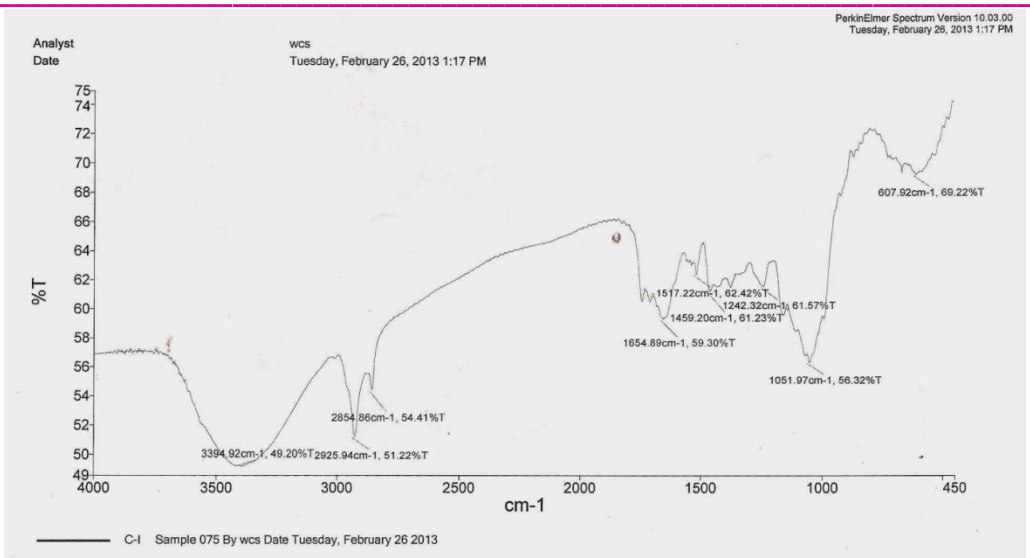


Figure 2 : IR spectrum of Wheat straws

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)

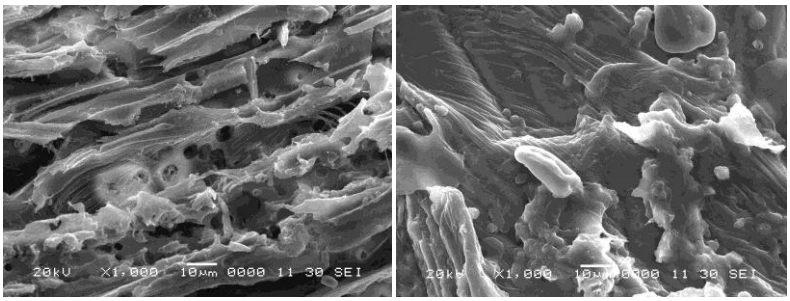


Figure 3
(Before adsorption) (After adsorption)
Scanning electron micrograph (SEM) of the Wheat straws **adsorbent**

EXPERIMENTAL PROCEDURE:

Group adsorption tests were directed by shaking 200ml 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 in addition distinctive time interims. The adsorbent was then evacuated by filtration and the convergence of color was assessed spectro photograph metrically at λ_{max}= 630 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 improved. 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 evacuated (Figure 4)

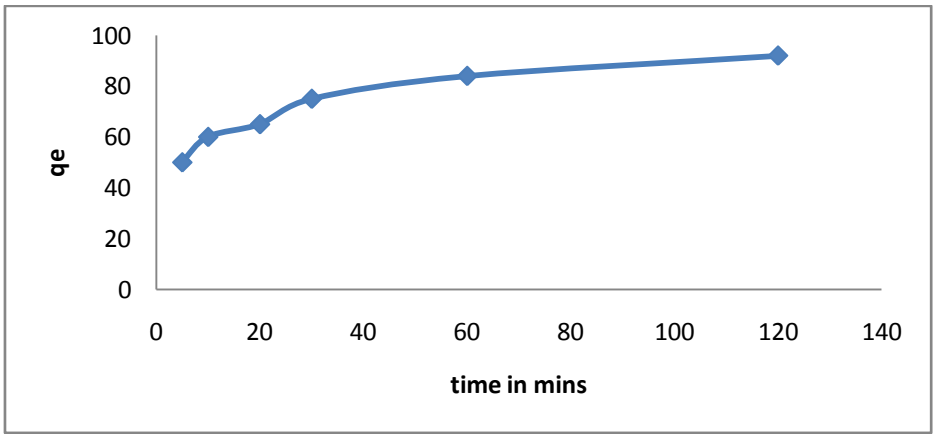


Figure 4 Effect of contact time on removal of Acid Rodamine Dyeby Wheat straws

Effect of p^H:

From (figure 5), it reveals that when p^H of the dye solution increases from 3 to 9 the percentage of dye removal also increases. At p^H= 9, adsorption is maximumby further increase in p^H adsorption decreases slightly. (Paul .*et al.*, 2014)

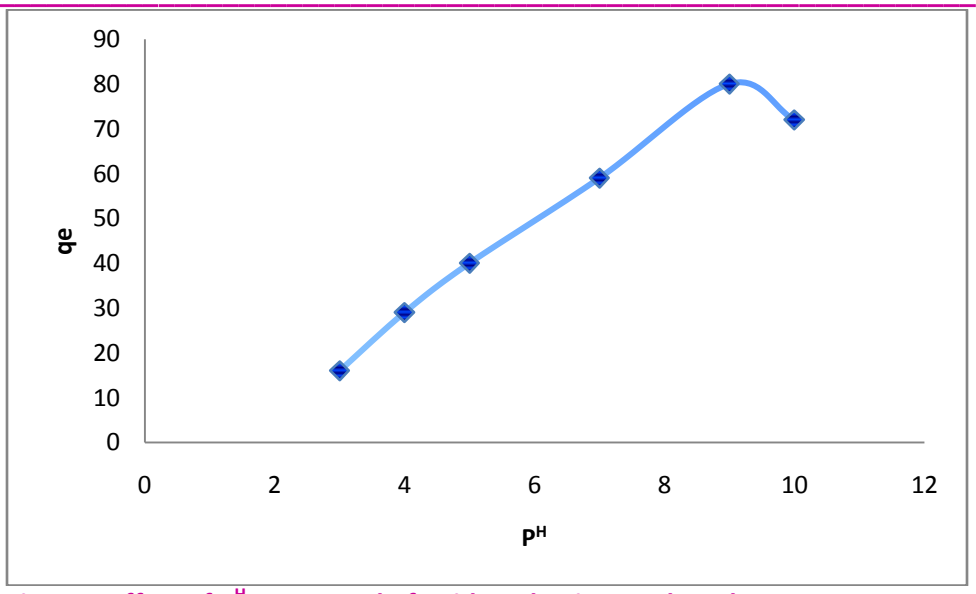


Figure 5 Effect of p^Hon removal of Acid Rodamine Dyeby Wheat straws

EFFECT OF ADSORBENT DOSE:

The diverse adsorbent portions were examined from the range 0.5gm to 7.0 gm from the outcomes, obviously the ideal portion is 1gm/150ml. (Figure 6). By further increment of adsorbent portion, the expulsion 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)

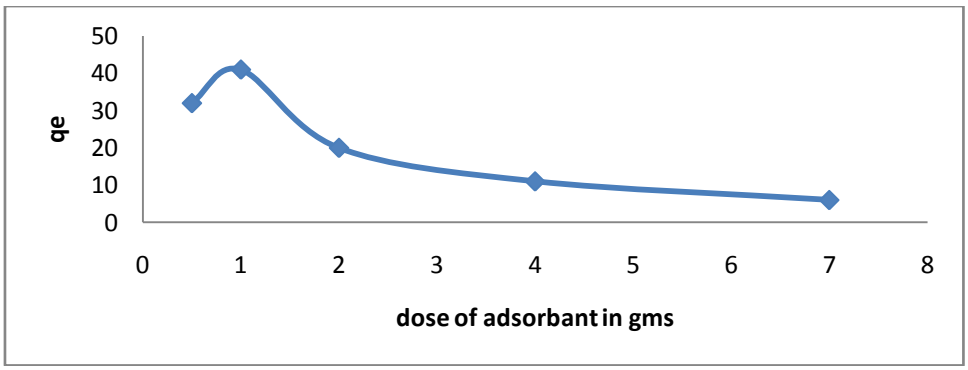


Figure 6 Effect of adsorbent doseon removal of Acid Rodamine Dyeby Wheat straws

Effect of temperature:

The perusal of(figure 7) it is clears that adsorption capacity of adsorbent increases with increase in temperature, due to increase in the mobility of dye ions. Increasing temperature also causes a swelling effect within the internal structure of adsorbent. So that large number of dye molecules can easily penetrate through it (Yamin Y*et al*., 2007) (Mane R.S. *et al*., 2012). The temperature range was 298K, 303K,308K.

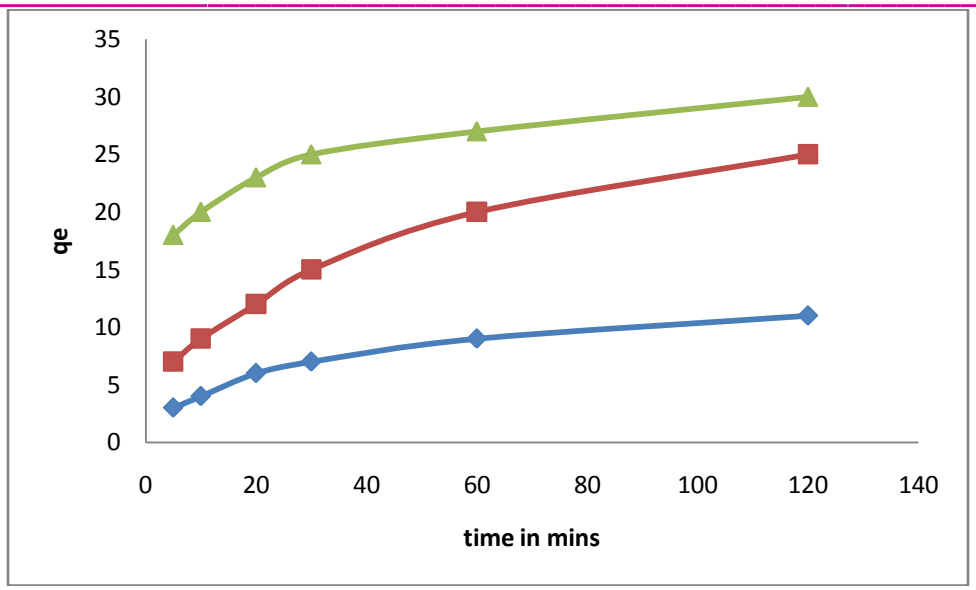


Figure 7 Effect of contact timeon removal of Acid Rodamine Dyeby Wheat straws

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)

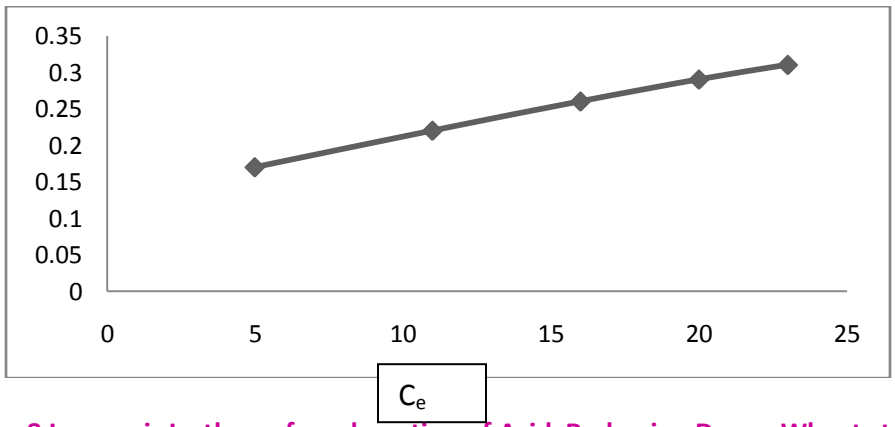


Figure 8 Langmuir Isotherm for adsorption of Acid Rodamine Dyeon Wheat straws

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)

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

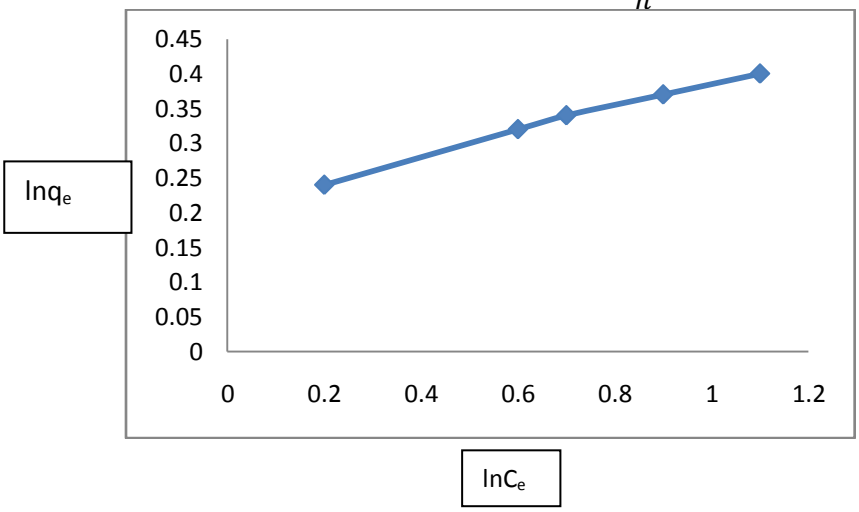


Figure 9 Freundlich Isotherm of Rodamine dye on wheat straw

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)

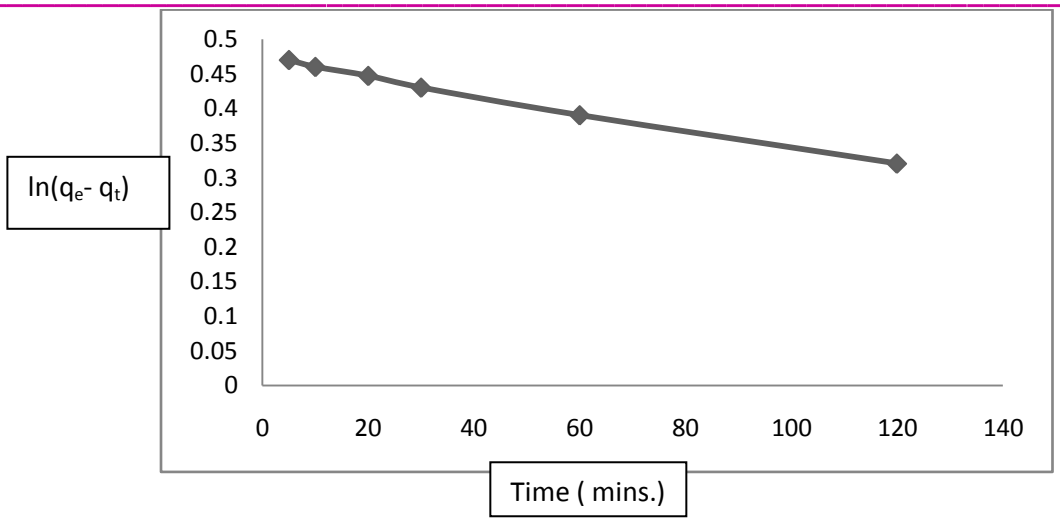


Figure 10 Plot of pseudo 1st order for adsorption of Rodamine Dye on wheat straw

Table no.1

Slope (K_i) (correlation coefficient)	Intercept (q_e) (Max. adsorption capacity)	Correlation Factor
-0.00100	0.45	-0.89

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)

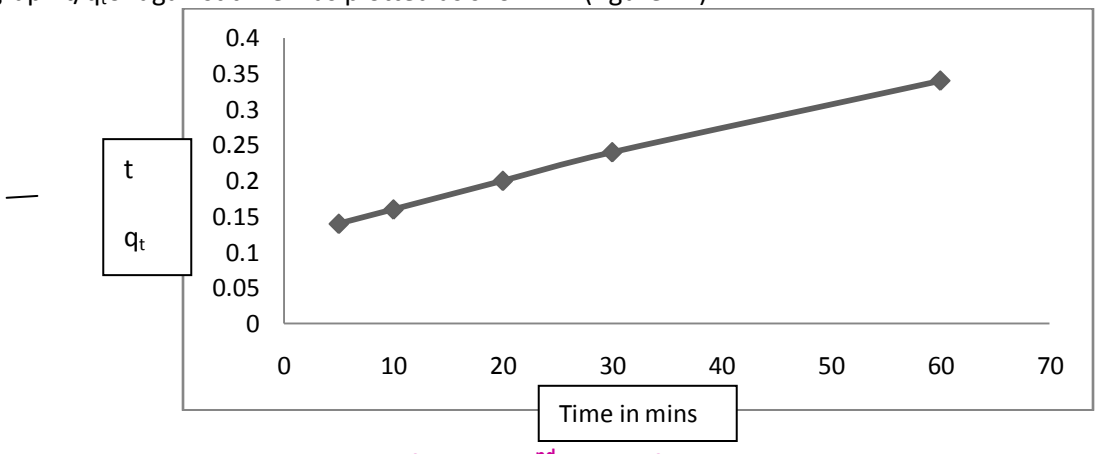


Figure 11 Plot of pseudo 2nd order of Neutral red dye on orange peel.

Slope (K_2)	Intercept (q_e)	Correlation factor
0.00340	0.117	0.89

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:

The order for the removal of basic dye like Neutral Red due isorange peel> Saw dust >Tendu leaves.Batch adsorption was shown that yield of adsorption increases by increasing adsorbent dose, contact time,pH,and temperature.The study of Langmuir model shows that there is a formation of monolayer on the adsorbent surfaces. Similarly Freundlich isotherm also develop in small scale.

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