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Exclusion of Dyes from Textile Effulent by using Natural Adsorbents (Neem Bark, Ocmium Teniflorum & Echhornia Crassipes)

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Abstract: Huge quantity of dyes and pigments produced annually throughout the world are used by textile industries. Effluents from these industries are colour dye wastewater and the disposal of these wastes into freshwater body's causes damage to environment. Among the treatment technologies, the adsorption is an attractive and viable treatment. The use of low cost, recycled waste and eco-friendly absorbent has been investigated as an alternative process for replacement of currently expensive process for removing dyes from wastewater. In this study, Neem Bark, Ocmium teniflorum, echhornia crassipes was used to remove dyes from aqueous solution in a adsorption techniques. Neem bark is an excellent low cost adsorbent and may have significant potential as a colour removal from textile wastewater. The effectiveness of Neem Bark, osmium tenuflorim, echhornia crassipes in adsorbing vat dyes from aqueous solutions was studied as a function of agitation time, adsorbent dosage, agitation speed, pH, temperature. In this study, the removal of colour or dye by Neem Barks, ocmium teniflorum and echhornia crassipes was found to be highly efficient 81.25 % at pH 7.3, contact time 45 min, temperature 29^0 C, adsorption dose 40 g/l & agitation speed 120 rpm and slightly better than Neem Barks 80.12 % at pH 7, contact time 45 min, temperature 31^0 C, adsorption dose 50 g/l & agitation speed 140 rpm. Ocimum teniflorum adsorbent dye removal efficiency is 75.89 % at pH 7.2, contact time 60 min, temperature 33^0 C, adsorption dose 60 g/l & agitation speed 120 rpm. The experimental data were fitted to Langmuir and Freundlich Isotherm and found that adsorption process follows both the isotherm. The values of Langmuir and Freundlich constants indicate favorable and beneficial adsorption. This was backed by a series of laboratory experiments. The results of which provide a better scientific understanding of the biodegradable material like Neem Bark, osmium teniflorum, echhornia crassipes and help realize their potential as commercial products.
Keywords: Dyeing wastewater, Adsorbents & Isotherms.

Introduction

About 15% of the total world production of dyes is lost during the dyeing process and is released as liquid effluents. Colour removal from such wastes is one of the most difficult requirements, faced by the textile finishing, dye manufacturing, pulp and paper industries. Among the various types of dye, various vat dyes, including green olive b, are used in dye and wool dyeing. Vat dyes is also used in cotton, wool, silk, nylon and other fibre making industries and it is a organic pollutants. The effluent containing dyes are highly coloured, resulting in major environmental problems. As International Environmental Standards are becoming more stringent, these coloured wastes need treatment before disposal. Several methods for the removal of dyes have been developed.

ADSORPTION

Adsorption is the adhesion of atoms, ions, or molecules from a gas, liquid, or dissolved solid to a surface. This process creates a film of the adsorbate on the surface of the adsorbent.

Testing of Parameters

Parameters	Typical Value
pH	9-12
Colour	Dark green
Total dissolved solids	2500-4000 mg/l
BOD	300-500 mg/l
COD	1000-1500 mg/l

1. Materials and Methods

Wastewater Collection:

Dyeing wastewater collected from Common Effluent Treatment Plant Sipcot, Perundurai. The wastewater can be considered as complex in nature due to the presence of acids, biofilm. After collection, the wastewater was transferred immediately to the laboratory and stored at room temperature, and the wastewater was not corrected for trace elements deficiency.

Material Preparation

Neem Bark

In the first time, the Neem bark was prepared in the following conditions: Fractions of the product were attacked by the hydrochloric acid HCl (6N). Then, the samples are dried then dried in steam at 80 °C during 12 h, crushed and sieved by a series sieves, the powder used for the experiments having a granulation 600 µ .

Activated and Powdered Neem Bark

Ocimum Teniflorum

In the first time, the Ocimum teniflorum were prepared in the following conditions: Fractions of the product were attacked by the hydrochloric acid HCl (6N). Then, the samples are dried then dried in steam at 80 °C during 12 h, crushed and sieved by a series sieves, the powder used for the experiments having a granulation 600 µ .

Activated and Powdered Ocimum Teniflorum

Echchornia Crassipes

In the first time, the Echchornia crassipes were prepared in the following conditions: Fractions of the product were attacked by the hydrochloric acid HCl (6N). Then, the samples are dried then dried in steam at 80 °C during 12 h, crushed and sieved by a series sieves, the powder used for the experiments having a granulation 600 µ .

Activated and Powdered Echchornia crassipes

Method of Dye Removal

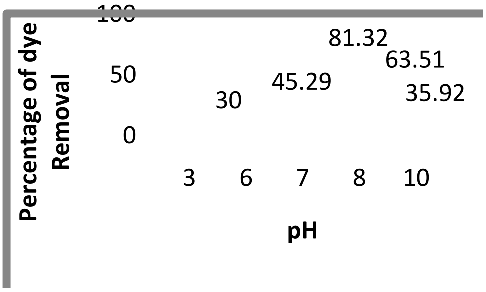
Batch experiments were conducted for maximum bio sorption of dye ions, through the following parameters.1.Effect of p^H, 2.Effect of contact time, 3.Effect of Temperature, 4.Biomass dose, 5.Agitation Speed.

Result and Discussion:

Neem Bark as Adsorbent:

Effect of pH

pH	REMOVAL EFFICIENCY(%)
3	30
6	45.29
7	80.12
8	63.51
10	35.92

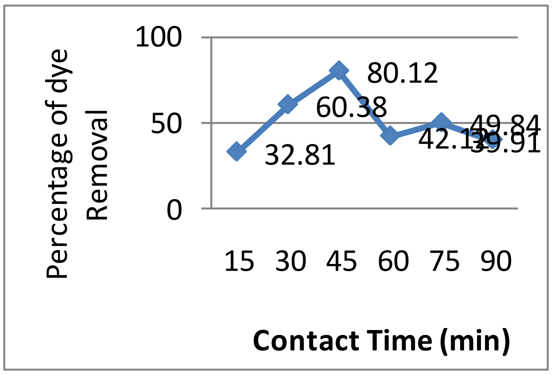


Effect of pH

The results showed that using adsorbent material, the percent removal of Green Olive B was decreased when the pH was increased at constant other variables. High adsorption of Green Olive B at pH = 7 can be explained in both terms; the species of Green Olive B and the adsorbent surface. For this case, at low pH, acidic conditions, the surface of the adsorbent becomes highly protonated and favours adsorb of above group of Green Olive B in the anionic form.
Finally the adsorption capacity is very higher level of pH =7.

Effect of Contact Time

CONTACT TIME (min)	REMOVAL EFFICIENCY (%)
15	32.81
30	60.38
45	80.12
60	42.12
75	49.84
90	39.91



Effect of Contact Time

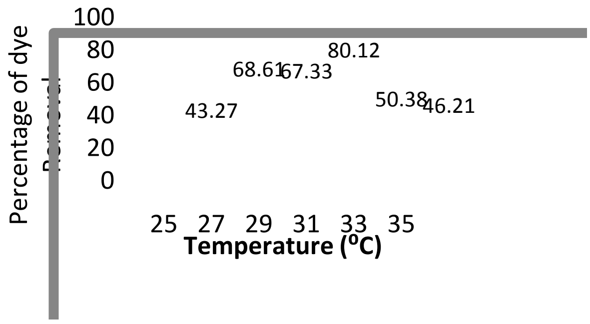
The results demonstrated that when the treatment time of Green Olive B of dyes increased the percent removal of dyes increased at constant other variables as shown in fig. This may be due to the fact that when the time of treatment of Green Olive B of dyes increasing and the velocity of Green Olive B in the column packed with the adsorbent material was remaining constant. So many contact times are followed from 15 min to 90 min. Contact time 45 min is the optimum time period for dye removal.

Effcts of Temperature:

The results demonstrated that when the temperature of feed which was Green Olive B of dyes was increased, the percent removal of dyes was increased too at constant other variables as shown in fig.

Effect of Temperature

TEMPERATURE(^{0}C)	REMOVAL EFFICINCY (%)
25	**43.27**
27	**68.61**
29	**67.33**
31	**80.12**
33	**50.38**
35	**46.21**



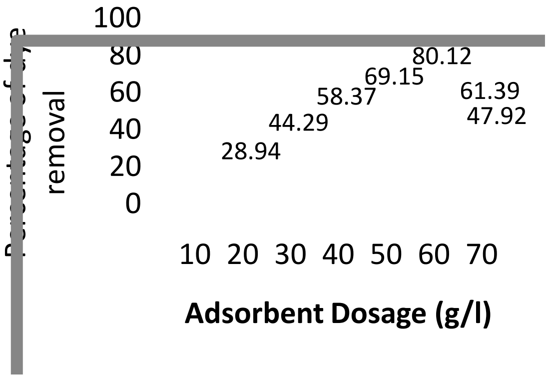
Effect of Temperature

The effect of temperature is fairly common and increasing the mobility of the acidic ion. Furthermore, increasing temperatures may produce a swelling effect within the internal structure of the adsorbent media enabling dyes ions to penetrate further. It was indicated that dyes adsorption capacity increased with increasing feed temperature from 25°C to 35°C. The best optimum temperature value of dye removal for Neem Barks adsorbents is 31°C. This effect may be due to the fact that at higher temperature an increase in active sites occurs due to bond rupture.

Effcts of Adsorption Dose

Effect of Adsorption Dose

ADSORPTION DOSE (g/l)	REMOVAL EFFICIENCY (%)
10	**28.94**
20	**44.29**
30	**58.37**
40	**69.15**
50	**80.12**
60	**61.39**
70	**47.92**



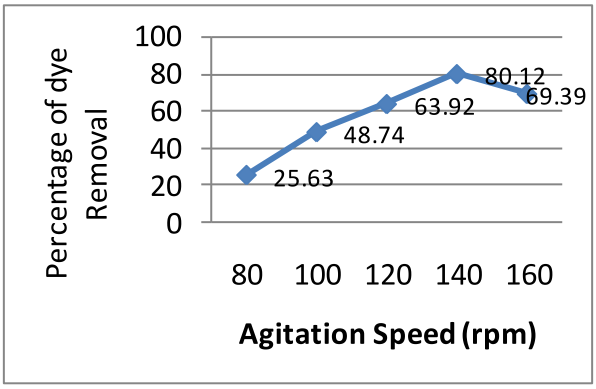
Effect of Adsorption Dosage

The results elucidated that when the adsorbent dosage amount was increased, the percent removal of dyes was increased too at constant other variables as shown in fig. 10 g/l to 70 g/l adsorbent dosages are used in this dye removal treatment. From this process the good adsorbent dosage level is attained at 50 g/l

Effcts of Agitation Speed

Effect of Agitation Speed

AGITATION SPEED (rpm)	REMOVAL EFFICIENCY (%)
80	25.63
100	48.74
120	63.92
140	80.12
160	69.39



Effect of Agitation Speed

Fig shows the adsorption capacity of the reactive dyes (Green Olive B) at different agitation speed (80,100, 120, 140 and 160 rpm). From the fig, it is clear that the dye uptake increases from 80 rpm to 120 rpm and shows a slight decrease at 160 rpm.

It is confirmed that 140 rpm is the optimum agitation for the adsorption process. At higher agitation speed there may be a process of desorption at the equilibrium time.

2. Adsorption Isotherms

The analysis of the isotherm data by fitting them to different isotherm models is an important step to find the suitable model that can be used for design of adsorption systems. Two adsorption isotherm models

Langmuir and Freundlich were used in this work. Adsorption isotherms play a very important role for understanding adsorption mechanism.

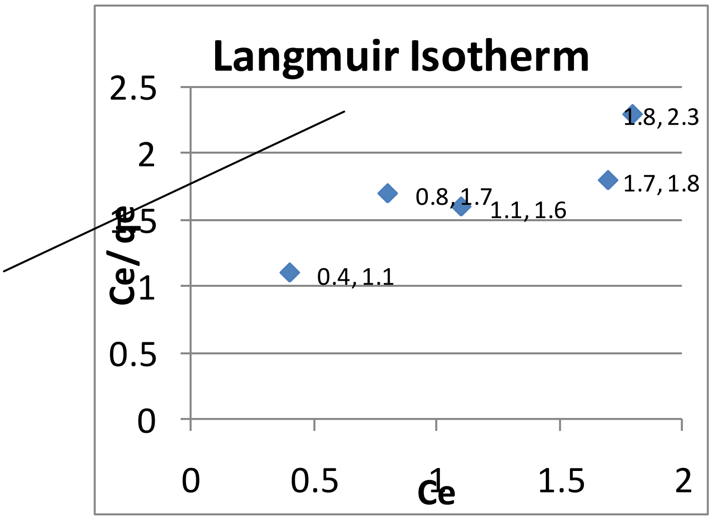
Langmuir Isotherm

The Langmuir isotherm assumes monolayer adsorption onto a surface containing a finite number of adsorption sites of uniform strategies of adsorption with no transmigration of adsorbate in the plane of surface. The Langmuir equation can be expressed in mathematical form as shown in Equation 1:

$$C_e / q_e = 1 / Q_o b \;\; + C_e / Q_o$$

Langmuir Isotherm

C_e	C_e/qe
0.4	**1.1**
0.8	**1.7**
1.1	**1.6**
1.7	**1.8**
1.8	**2.3**



Langmuir Isotherm Model

Freundlich Isotherm

The Freundlich isotherm describes equilibrium on heterogeneous surfaces and hence does not assume monolayer capacity and used to describe the adsorption. It relates the adsorbed concentration as the power functions of solute concentration.

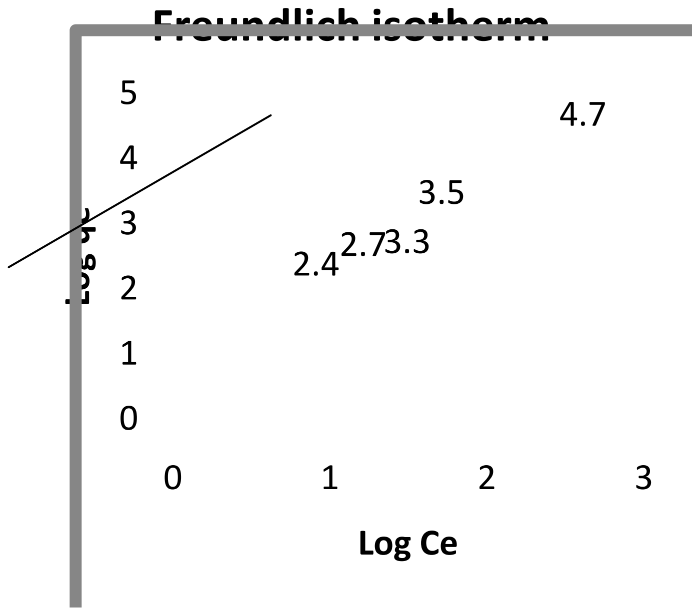
One of the limitations of the Freundlich model is that the amount of adsorbed solute increases indefinitely with the concentration of solute in the solution. This empirical equation takes the form as in Equation 1.

$$q_e = K_f Ce^{1/n}$$

$$\text{Log}\ (q_e) = \log K_f + 1/n \log (C_e)$$

Freundlich Isotherm

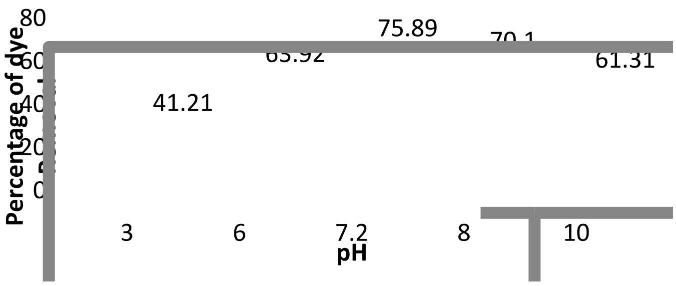
Log C_e	**Log q_e**
0.6	**2.4**
0.9	**2.7**
1.2	**3.3**
1.4	**3.5**
2.3	**4.7**



Freundlich Isotherm Model

Osimum Teniflorum as Adsorbent
Effect of pH

pH	REMOVAL EFFICIENCY (%)
3	**41.21**
6	**63.92**
7.2	**75.89**
8	**70.10**
10	**61.31**



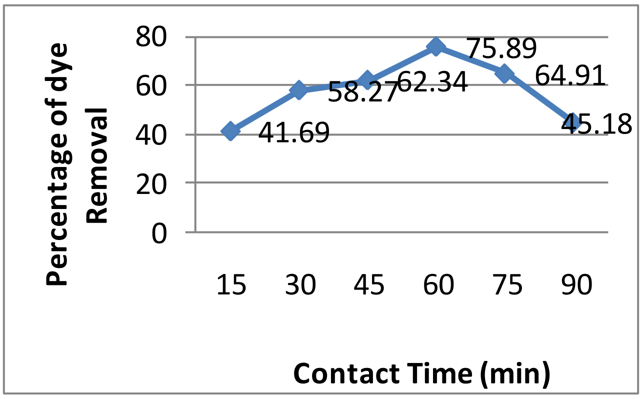
Effect of pH

The results showed that using adsorbent material, the percent removal of Green Olive B was decreased when the pH was increased at constant other variables. It is well recognized that the pH of the aqueous solution is an important parameter in affecting adsorption of heavy metal ions. High adsorption of Green Olive B at pH = 7.2 can be explained in both terms; the species of Green Olive B and the adsorbent surface. For this case, at low pH, acidic conditions, the surface of the adsorbent becomes highly protonated and favours adsorb of above group of Green Olive B in the anionic form.

With increasing the pH of wastewater sample, the degree of protonation of the adsorbent surface reduces gradually and hence adsorption is decreased. Furthermore, as pH increases there is competition between hydroxide ion and species of Green Olive B, the former being the dominant species at higher pH values. The net positive surface potential of sorbent media decreases, resulting in a reduction the electrostatic attraction between the (sorbent) Green Olive B species and the (sorbate) adsorbent material surface, with a consequent reduced sorption capacity which ultimately leads to decrease in percentage adsorption of Green Olive B. Finally the adsorption capacity is very higher level of ph=7.2.

Effect of Contact time

CONTACT TIME (min)	REMOVAL EFFICIENCY (%)
15	41.69
30	58.27
45	62.34
60	75.89
75	64.91
90	45.18



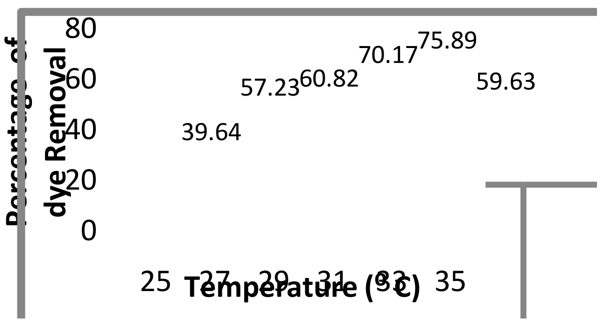
Effect of Contact Time

The results demonstrated that when the treatment time of Green Olive B of dyes increased the percent removal of dyes increased at constant other variables as shown in fig. This may be due to the fact that when the time of treatment of Green Olive B of dyes increasing and the velocity of Green Olive B in the column packed with the adsorbent material was remaining constant, the solution spend longer time than that spend it when the time of treatment decreased, so the adsorbent material uptake more amount of dyes from Green Olive B, therefore the percent removal of dyes from Green Olive B was increased. So many contact times are followed from 15 min to 90 min. Contact time 60 min is the optimum time period for dye removal.

Effct of Temperature:

Effect of Temperature

TEMPERATURE (^{0}C)	REMOVAL EFFICINCY (%)
25	39.64
27	57.23
29	60.82
31	70.17
33	75.89
35	59.63

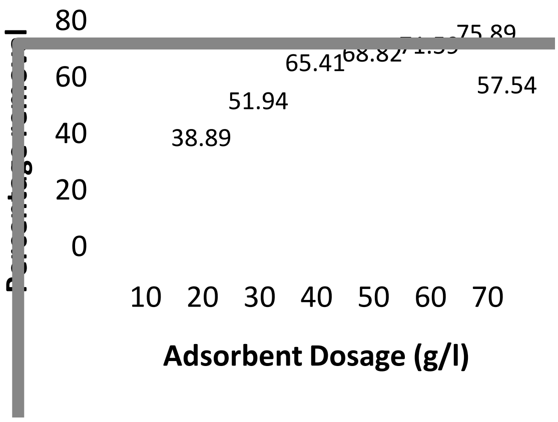


Effect of Temperature

The effect of temperature is fairly common and increasing the mobility of the acidic ion. Furthermore, increasing temperatures may produce a swelling effect within the internal structure of the adsorbent media enabling dyes ions to penetrate further. It was indicated that dyes adsorption capacity increased with increasing feed temperature from 25 to 35°C. The best optimum temperature value of dye removal for Neem Barks adsorbents is 33°C.

Effect of Adsorption Dose

ADSORPTION DOSE (g/l)	REMOVAL EFFICIENCY (%)
10	**38.89**
20	**51.94**
30	**65.41**
40	**68.82**
50	**71.59**
60	**75.89**
70	**57.54**

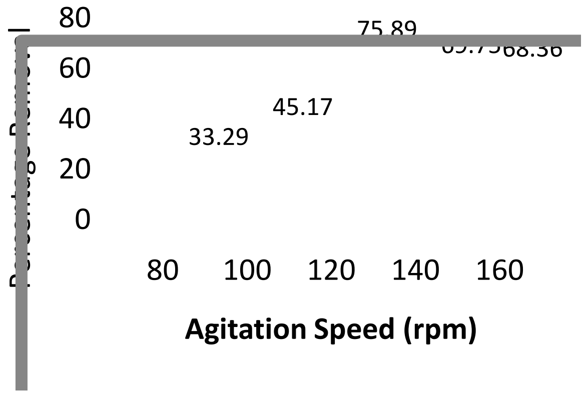


Effect of Adsorption Dosage

The results elucidated that when the adsorbent dosage amount was increased, the percent removal of dyes was increased too at constant other variables as shown in fig. The increased in the amount of adsorbent dosage Osimum Teniflorum, thus increasing the surface area of adsorbent material, hence increased the number of active sites in the adsorbent material surface increased the availability of binding sites for adsorption and consequently increase dyes removal capacity on Osimum Teniflorum . 10 g/l to 70 g/l adsorbent dosages are used in this dye removal treatment. From this process the good adsorbent dosage level is attained at 60 g/l. This lead to increase the ability of adsorbent dosage to adsorb greater amount of dyes from Green Olive B at different pH and ultimately the percent removal of dyes level increased.

Effect of Agitation Speed

AGITATION SPEED (rpm)	REMOVAL EFFICIENCY (%)
80	**33.29**
100	**45.17**
120	**75.89**
140	**69.75**
160	**68.36**



Effect of Agitation Speed

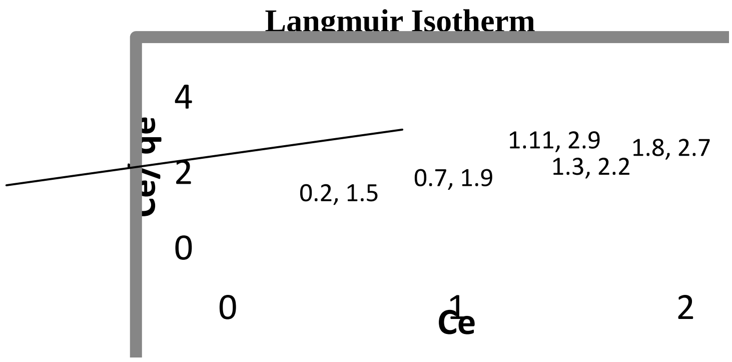
Fig shows the adsorption capacity of the reactive dyes (Green Olive B) at different agitation speed (80,100, 120, 140 and 160 rpm). From the fig, it is clear that the dye uptake increases from 80 rpm to 140 rpm and shows a slight decrease at 160 rpm.

It is confirmed that 120 rpm is the optimum agitation for the adsorption process. At higher agitation speed there may be a process of desorption at the equilibrium time. Thus, the difference in agitation speed causes change in kinetics of the adsorption, as well as the equilibrium adsorption capacity. The increase in dye uptake at the optimum speed (120 rpm) reduces the film boundary layer surrounding particles, thus increasing the external film transfer coefficient and hence the percentage dye removal.

Adsorption Isotherms

Langmuir Isotherm

C_e	C_e/qe
0.2	**1.5**
0.7	**1.9**
1.3	**2.2**
1.8	**2.5**
1.11	**2.9**



Langmuir Isotherm Model

The Langmuir isotherm assumes monolayer adsorption onto a surface containing a finite number of adsorption sites of uniform strategies of adsorption with no transmigration of adsorbate in the plane of surface. The Langmuir equation can be expressed in mathematical
form as shown in Equation 1:

$$C_e / q_e = 1 / Q_o b + C_e / Q_o$$

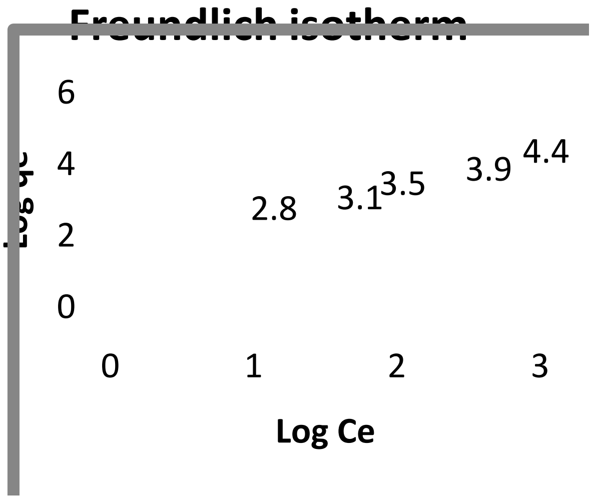
Where, C_e is the equilibrium concentration (mg/L), q_e is the amount adsorbed at equilibrium (mg/g), Q_o is the adsorption capacity (mg/g) and b is the energy of adsorption (Langmuir constant, l/mg). The maximum adsorption of Langmuir constant were calculated from the linear plots Ce/qe versus Ce to determine the value of

Q_o (mg/g) and b (L/mg), which gives a straight line of slope $1/Q_o$, corresponding to complete monolayer coverage (mg/g) and the intercept is $1/Q_o$ The maximum adsorption capacity Q_o was found to increase with the temperature, thereby enhancing the mobility of the dye ions. This led to a higher chance of the reactive dyes being adsorbed onto the adsorbent and an increase in its adsorption capacity which resulted in the enlargement of pore size or activation of the adsorbent surface. The isotherm showed no linear variation for the Langmuir constant b and hence the kinetic energy of the dye was independent. This indicates the applicability of the isotherm (Langmuir isotherm) and the surface.

Freundlich Isotherm Model

Freundlich Isotherm

Log C_e	Log q_e
0.8	**2.8**
1.4	**3.1**
1.7	**3.7**
2.3	**3.9**
2.7	**4.4**



Freundlich Isotherm Model

The Freundlich isotherm describes equilibrium on heterogeneous surfaces and hence does not assume monolayer capacity and used to describe the adsorption. It relates the adsorbed concentration as the power functions of solute concentration. One of the limitations of the Freundlich model is that the amount of adsorbed solute increases indefinitely with the concentration of solute in the solution. This empirical equation takes the form as in Equation

$$q_e = K_f Ce^{1/n}$$

The logarithmic form of the equation becomes Equation

$$\text{Log}(q_e) = \log K_f + 1/n \log(C_e)$$

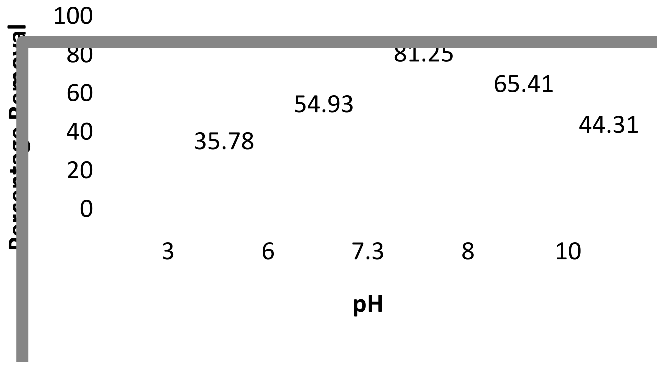
Where, K_f and n are the Freundlich constants, characteristic of the system. K_f and n is an indicator of the adsorption capacity and adsorption intensity, respectively. The slope and the intercept of the linear Freundlich equation are equal to 1/n and $\ln K_f$ respectively. It has been shown that n values between 1 and 10 represent good adsorption potential of the adsorbent.

The linear correlation between the Freundlich constants (KF and n) and the adsorption capacities were not observed. Hence the adsorption of the solute concentration is not evident. This shows the complex nature of the adsorption of reactive dyes onto the Neem Bark adsorbents. The experimental data are well suited to the Freundlich isotherm than the Langmuir isotherm. Therefore the adsorptions of the reactive dyes under consideration are linear in Langmuir isotherm plot.

Dye Removal Using Echhornia Crassipes as Adsorbent

Effect of pH

pH	REMOVAL EFFICIENCY (%)
3	**35.78**
6	**54.93**
7.3	**81.25**
8	**65.41**
10	**44.31**



Effect of pH

The results showed that using adsorbent material, the percent removal of Green Olive B was decreased when the pH was increased at constant other variables. It is well recognized that the pH of the aqueous solution is an important parameter in affecting adsorption of heavy metal ions. High adsorption of Green Olive B at pH = 7.3 can be explained in both terms; the species of Green Olive B and the adsorbent surface. For this case, at low pH, acidic conditions, the surface of the adsorbent becomes highly protonated and favours adsorb of above group of Green Olive B in the anionic form.

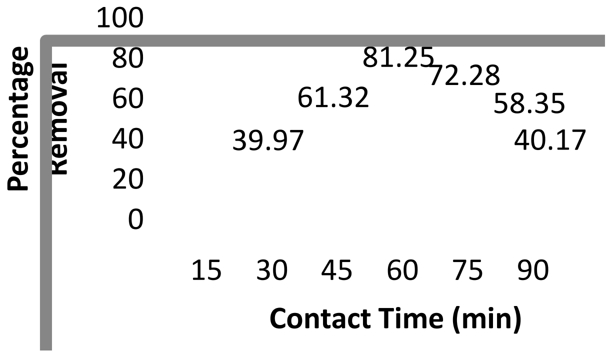
With increasing the pH of wastewater sample, the degree of protonation of the adsorbent surface reduces gradually and hence adsorption is decreased. Furthermore, as pH increases there is competition between hydroxide ion and species of Green Olive B, the former being the dominant species at higher pH values. The net positive surface potential of sorbent media decreases, resulting in a reduction the electrostatic attraction between the (sorbent) Green Olive B species and the (sorbate) adsorbent material surface, with a consequent reduced sorption capacity which ultimately leads to decrease in percentage adsorption of Green Olive B. Finally the adsorption capacity is very higher level of pH =7.3.

Effcts of Contact Time

Effect of Contact Time

CONTACT TIME (min)	REMOVAL EFFICIENCY (%)
15	**39.97**
30	**61.32**

45	**81.25**
60	**72.28**
75	**58.35**
90	**40.17**



Effect of Contact Time

The results demonstrated that when the treatment time of Green Olive B of dyes increased the percent removal of dyes increased at constant other variables as shown in fig. Olive B of dyes increasing and the velocity of Green Olive B in the column packed with the adsorbent material was remaining constant, the solution spend longer time than that spend it when the time of treatment decreased, so the adsorbent material uptake more amount of dyes from Green Olive B, therefore the percent removal of dyes from Green Olive B was increased. So many contact times are followed from 15 min to 90 min. Contact time 45 min is the optimum time period for dye removal.

Effct of Temperature

The results demonstrated that when the temperature of feed which was Green Olive B of dyes was increased, the percent removal of dyes was increased too at constant other variables as shown in fig.

Effect of Temperature

TEMPERATURE (^{0} C)	REMOVAL EFFICINCY (%)
25	**48.19**
27	**50.73**
29	**81.25**
31	**72.84**
33	**69.47**
35	**61.78**

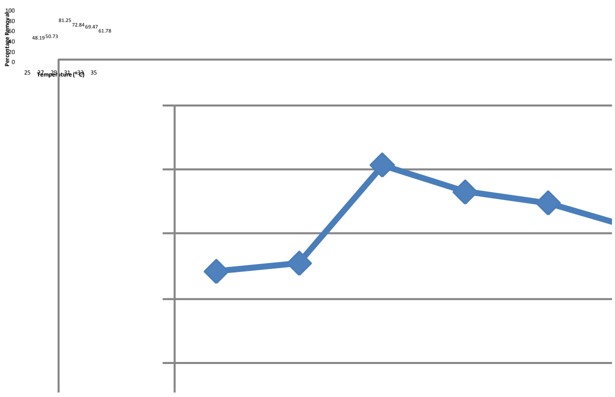


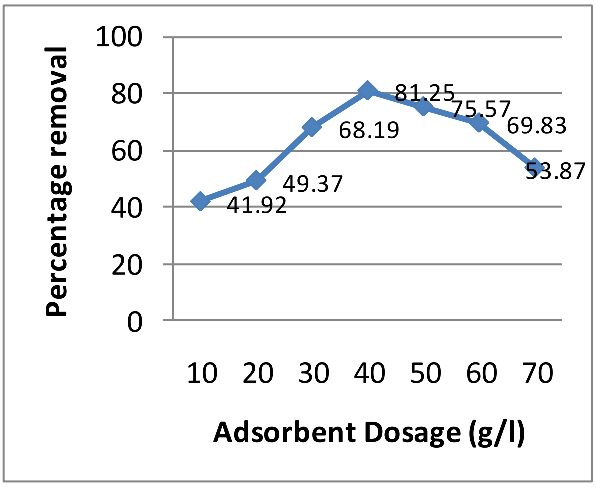
Fig Effect of Temperature

The effect of temperature is fairly common and increasing the mobility of the acidic ion. Furthermore, increasing temperatures may produce a swelling effect within the internal structure of the adsorbent media enabling dyes ions to penetrate further. It was indicated that dyes adsorption capacity increased with increasing feed temperature from 25°C to 35°C. The best optimum temperature value of dye removal for Neem Barks adsorbents is 29°C. This effect may be due to the fact that at higher temperature an increase in active sites occurs due to bond rupture.

Effcts of Adsorption Dose

Effect of Adsorption Dose

ADSORPTION DOSE (g/l)	REMOVAL EFFICIENCY (%)
10	41.92
20	49.37
30	68.19
40	81.25
50	75.57
60	69.83
70	53.87



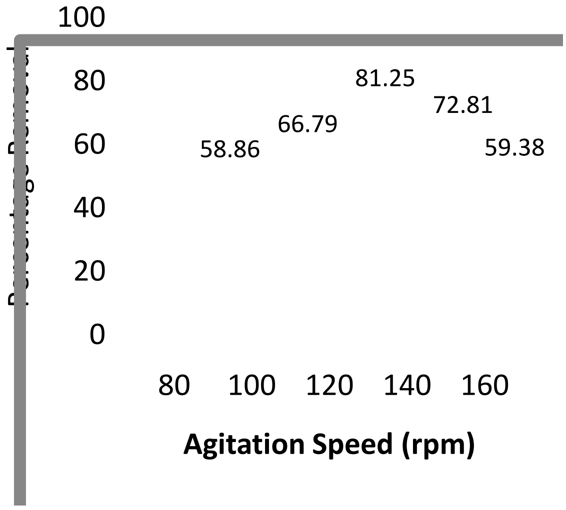
Effect of Adsorption Dosage

The results elucidated that when the adsorbent dosage amount was increased, the percent removal of dyes was increased too at constant other variables as shown in fig. The increased in the amount of adsorbent dosage Echhornia crassipes, thus increasing the surface area of adsorbent material, hence increased the number of active sites in the adsorbent material surface increased the availability of binding sites for adsorption and consequently increase dyes removal capacity on Echhornia crassipes. 10 g/l to 70 g/l adsorbent dosages are used in this dye removal treatment. From this process the good adsorbent dosage level is attained at 40 g/l. This lead to increase the ability of adsorbent dosage to adsorb greater amount of dyes from Green Olive B at different pH and ultimately the percent removal of dyes level increased.

Effcts Of Agitation Speed

Effect of Agitation Speed

AGITATION SPEED (rpm)	REMOVAL EFFICIENCY (%)
80	**58.86**
100	**66.79**
120	**81.25**
140	**72.81**
160	**59.38**



Effect of Agitation Speed

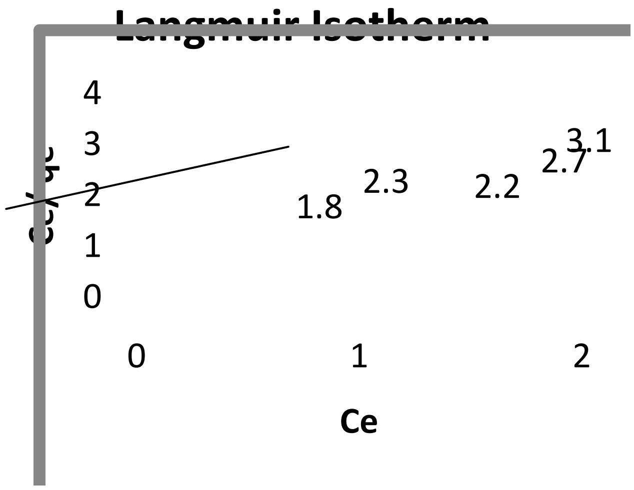
Fig shows the adsorption capacity of the reactive dyes (Green Olive B) at different agitation speed (80, 100,120,140 and 160 rpm). From the figure, it is clear that the dye uptake increases from 80 rpm to 140 rpm and shows a slight decrease at 160 rpm.

It is confirmed that 120 rpm is the optimum agitation for the adsorption process. At higher agitation speed there may be a process of desorption at the equilibrium time. Thus, the difference in agitation speed causes change in kinetics of the adsorption, as well as the equilibrium adsorption capacity. The increase in dye uptake at the optimum speed (120 rpm) reduces the film boundary layer surrounding particles, thus increasing the external film transfer coefficient and hence the percentage dye removal.

Adsorption Isotherms

Langmuir Isotherm

C_e	C_e/qe
0.6	**1.8**
0.9	**2.1**
1.4	**2.4**
1.7	**2.7**
1.9	**3.1**



Langmuir Isotherm Model

The Langmuir isotherm assumes monolayer adsorption onto a surface containing a finite number of adsorption sites of uniform strategies of adsorption with no transmigration of adsorbate in the plane of surface. The Langmuir equation can be expressed in mathematical
form as shown in Equation 1:

$C_e / q_e = 1 / Q_o b \quad + C_e / Q_o$

The isotherm showed no linear variation for the Langmuir constant b and hence the kinetic energy of the dye was independent. This indicates the applicability of the isotherm (Langmuir isotherm) and the surface.

Freundlich Isotherm

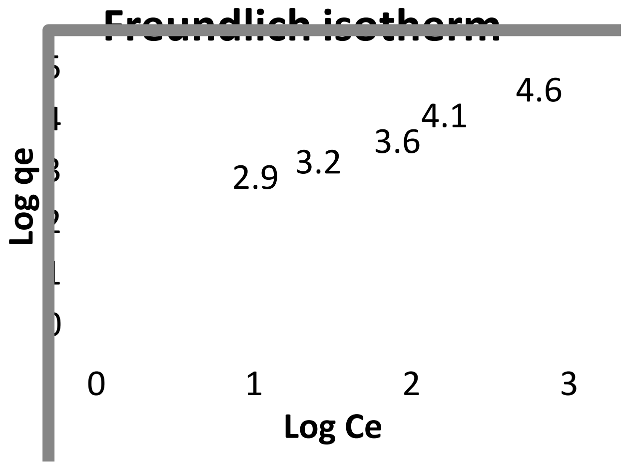
Freundlich Isotherm

Log C_e	Log q_e
0.7	**2.9**
1.1	**3.2**
1.6	**3.6**
1.9	**4.1**
2.5	**4.6**

$q_e = K_f Ce^{1/n}$

$\text{Log}(q_e) = \log K_f + 1/n \log (C_e)$

Hence the adsorption of the solute concentration is not evident. This shows the complex nature of the adsorption of reactive dyes onto the Neem Bark adsorbents. The experimental data are well suited to the Freundlich isotherm than the Langmuir isotherm. Therefore the adsorptions of the reactive dyes under consideration are linear in Langmuir isotherm plot.



Freundlich Isotherm Model

3. Conclusion:

A review of various adsorbents presented shows a good potential for the removal of dyes from wastewater. The adsorption capacity depends on the type of adsorbent and the nature of wastewater. The expensive adsorbents can be replaced by the low cost adsorbents for the removal of dyes from wastewater. Neem Barks, Osimum Teniflorum and Echhornia crassipes efficiently removed contaminants from dye wastewater; removal was dependent on dosage and contact time, agitation speed, temperature. In this study, the removal of colour or dye by Neem Barks, Osimum Teniflorum and Echhornia crassipes was found to be highly efficient 81.25 % at pH 7.3, contact time 45 min, temperature 29^0 C, adsorption dose 40 g/l & agitation speed 120 rpm and slightly better than Neem Barks 80.12 % at pH 7, contact time 45 min, temperature 31^0 C, adsorption dose 50 g/l & agitation speed 140 rpm. Osmium Teniflorum adsorbent dye removal efficiency is 75.89 % at pH 7.2, contact time 60 min, temperature 33^0 C, adsorption dose 60 g/l & agitation speed 120 rpm.

Moreover, the equilibrium data were well modelled by both the Freundlich and Langmuir isotherms, but the data fit slightly better under the Freundlich model which explains that colour has the highest adsorption bond among others. These adsorption processes were found to be an effective method for reducing colour or dye in the dye wastewater samples.

High Dye Removal efficiency is 81.25 %. These experimental studies have indicated that the Echhornia crassipes has the potential to act as an adsorbent for the removal of the Green Olive B from aqueous solutions. The effects of contact time, adsorbent dosage, agitation speed, temperature and pH on the reactive dye removal were determined with the experimental data. The adsorption data correlated well with Freundlich model as compared to the Langmuir isotherm model. The Freundlich plot of Green Olive B showed higher adsorbent capacity.

References:

[1]. Akar, T., Demir, T.A., Kiran, I., Oscan, A., Oscan, A.S., Tunali, S. (2006) ‘Bio sorption potential of Neurospora crassa cells for decolourization of Acid Red 57 (AR57) dye’. J. Chem. Technol. Biotechnol. 81 1100–1106.

[2]. Akar, T., Oscan, A.S., Tunali, S., Oscan, A. (2008) ‘Bio sorption of a textile dye (Acid Blue 40) by cone biomass of Thuja orientalis: estimation of equilibrium, thermodynamic and kinetic parameters’. Bioresour. Technol. 99 3057–3065.

[3]. Bakshi, D.K., Saha, S., Sindhu, I., Sharma, P. (2006) ‘Use of Phanerochaete chrysosporium biomass for the removal of textile dyes from a synthetic effluent. World J. Microbiol’. Biotechnol. 22 835–839.

[4]. Banks, C.J., Parkinson, M.E. (1992) ‘The mechanism and application of fungal bio sorption to color removal from raw waters’. J. Chem. Technol. Biotechnol. 54192–196.

[5]. Behnajady, M.A., Modirshahla, N., Hamzavi, R. (2006) ‘Kinetic study on photo catalytic degradation of C.I. Acid Yellow 23 by ZnO photo catalyst’. J. Hazard. Mater. 133 226–232

[6]. Christie, R.M. (2007). ‘Environmental Aspects of Textile Dyeing’. Woodhead, Boca Raton, Cambridge

[7]. F.A. Pavan, A.C. Mazzocato, Y. Gushikem (2008), 'Removal of Methylene Blue dye from aqueous solutions by adsorption using yellow passion fruit peel as adsorbent, Bioresourse Technology'. vol.99, pp. 3162-3165.

[8]. Hassler, J.W. (1963) 'Activated Carbon. Chemical Publishing Company', Inc., New York.

[9]. Hunger, K. (2003) 'Industrial Dyes: Chemistry, Properties, Applications'. Wiley-VCH, Weinheim;[Cambridge].

[10]. Khattri, S D and Singh M K (2000). 'Colour removal from synthetic dye waste water using a bio adsorbent'. Water, Air and Soil Pollution, 120, pp283-294.

[11]. Kim, T.H., Park, C., Yang, J.M., Kim, S. (2004) 'Comparison of disperse and reactive dye removals by chemical coagulation and Fenton oxidation'. J. Hazard. Mater. 112, 95-103.

[12]. Kanan, N, Meenakshisundaram M and Johnson R (2009). 'Removal of Azure A from aqueous solution by CAC and New Activated carbon Form Orange peel And Lemon Peel'. EJEAFChe, 8(8), pp 574-583.

[13]. Mas Rosemal H. Mas Harris and Kathiresan Sathasivam (2009), 'The removal of methyl red from aqueous solutions using banana pseudo stem fibers', Am J Applied Sci. 6 (9), 1690-1700.

[14]. McKay, G., Otter burn, M.S. and Aga (1985), 'Fuller's earth and fired clay as absorbents for dyestuffs external mass transport processes during adsorption, Water, Air and Soil Pollution'. 24, pp 307-322.

[15]. 'Methods of Sampling and tests for activated carbon use for decolourising vegetable oils and sugar solutions' ISI –877 (1977).

[16]. Morita, M., Ito, R., Kamidate, T., Watanabe, H. (1996). 'Kinetics of peroxidise catalyzed decolouration of Orange II with hydrogen peroxide'. Text. Res. J. 66 470 473.