International Journal of Advanced Information in Engineering Technology (IJAIET)
Vol.5, No.5, May 2018 ISSN: 2454-6933

COLOUR AND DYES REMOVAL OF TEXTILE EFFLUENT USING LOW COST BIOMATERIALS

Sahla c, Anitha k

Malabar College of Engineering and Technology, Kerala Technology University

Sahla703nazer@gmail.com,anithasubash@gmail.com

Abstract

Textile industry is one of the most important and rapidly developing industrial sectors. The characteristics of Textile effluent are generally high because of use of many chemical substances in textile processing. There have been various promising techniques for the removal of dyes from wastewater. However, the effectiveness of adsorption for dye removal from wastewater has made it an ideal alternative to other expensive treatment methods. Almond shell and Rice Husk Ash (RHA) and saw dust were used as adsorbents for dye removal. There adsorption capacity was evaluated for the decolourisation of wastewater containing methylene blue and methyl orange. The effect of system variables such as contact time and adsorbent dose were investigated. Among all these methods adsorption is still a procedure of choice for colour removal.This paper shows an experimental study of the combination of all materials

Index Term-Almond shell, Rice huskash, saw dust, Methylene blue, methyl orange, Adsorption isotherms.

1. INTRODUCTION

Dyes are widely used in industries such as textiles, rubber, plastics, printing, leather, cosmetics, etc., to colour their products. As a result, they generate a considerable amount of colouredwastewater.Colour removal from textile effluents on a continuous industrial scale has been given much attention in the last few years, not only because of its potential toxicity, but also mainly due to its visibility problem. There have been various promising techniques for the removal of dyes from wastewater. However, the effectiveness of adsorption for dye removal from wastewater has made it an ideal alternative to other expensive treatment methods.One of the most common water pollutant is colour. They find there way into the water by the discharge of dyes from paper and pulp industries, textile industries, tanning industries and many other industries. Some of the dyes cause rapid depletion of dissolved oxygen affecting aquatic life adversely. Some of the dyes are toxic and carcinogenic. Various treatment methods for removal of colour and dye are coagulation using alum, lime, ferric chloride and ferric sulphate, oxidation, flocculation, ozonisation, biological treatment, adsorption and membrane processes. Among these methods, adsorption method appears to offer the best prospect for overall treatment of colour removal.Types of textile dyes are Acid dyes, direct dyes, azoic dyes, disperse dyes reactive dyes, basic dyes, oxidation dyes, mordant dyes(chrome dyes), vat dyes.

II.MATERIALS AND METHODS

Three types of biomaterials are used asadsorbate.

1. Almond shell

Almond shell is easily available biomaterial, which its tree are there around us, and this is used as the low cost adsorbate. Almond shell is collected from Shornur. The collected material was first washed with distilled water to remove soluble impurities. It was then dried in an oven for 24 h at 353 K. The dried biomass was powdered and sieved to obtain different mesh size (no) ranges. It was finally stored in an airtight plastic container to use as adsorbent without any pre -treatments for the adsorption works.

2. Saw dust

Saw dust is collected from the nearby mill,The sawdust was collected from the local saw mill and sieved through a mesh of size 0.5 mm. The collected saw dust sample is cleaned with water and dried in the atmosphere. After drying it is soaked with the concentrated sulphuric acid for 24 hours. Then washed with distilled water and again soaked in the sodium carbonate solution for 30 minutes to remove residue acid .Then washed with distilled water and oven dried for one hour at 100°c.Sieved the sample through 0.3mm sieve. The obtained sawdust then treated with H_2 O_2 for 30 min. And finally add 10% con. HNO_3 with constant stirring for 40 min. Washed and oven dried at 100°c for another 24 hours .Then, it was washed with distilled water to remove the surface adhered particles and dried at a temperature of 60-800C in an oven.

3. Rice husk ash

Rice husk and rice husk ash were collected from shamna rice mill situated in Palakkad district of kerala state. The rice husk was screened and washed with water to remove the dirt and was sun dried for a day.

4. Textile effluent

Textile effluent is collected from Kerala khadi and village industry in thrissur district of kerala state. The effluent is in dark colour and it contain different types of dyes like

Methylene blue
Methylene orange
Bat dye

Fig.1 Effluent

5. Treatment methods

Various treatment methods are discovered for the removal of colour and dye are coagulation using alum, lime, ferric chloride and ferric sulphate, oxidation, flocculation, ozonation, biological treatment, adsorption and membrane processes. Among these methods, adsorption method appears to offer the best prospect for overall treatment of colour removal. Because this method is very effective and also easy to work. Other methods are very limited and not friendly. There are so many adsorbate are present, both chemically and biologically. Biological materials are

very cheap and easily available.

6. Batch adsorption

The influence of rice husk ash, almond shell, and saw dust on dyes was removed andinvestigated under the following experimental conditions. Batch experiments were conducted for varied Adsorbent dose and contact time. At desired intervals, effluent samples were collected,The removal efficiency of adsorption by the adsorbent was calculated as.

% adsorption = $\frac{ci - cf}{ci}$

Where, Ci and Cf are the initial and final concentrations of the metal ions in the solution (ppm).

Fig.2 Batch adsorption

6. Spectrophotometer

Adsorption efficiency of RHA saw dust and almond shell powder are detected using spectrophotometer. Spectrophotometry is a method to measure how much a chemical substance absorbs light by measuring the intensity of light passes through sample solution. The basic principle used in spectrophotometer is that each compound absorbs or transmits light over a certain range of wavelength. In a fixed concentrations of effluent were tested in the spectrophotometer at a wave length of 400nm for sawdust,610nm for RHA and 464nm for almond shell powder and the absorbance is calculated in different contact time and different absorbent dosage.

III.RESULT AND DISCUSSIONS

Adsorption studies have been conducted for the removal dyes like methylene blue, methyl orange and to reduce the colour from textile waste water. In order to design adsorption system, optimization of various operating parameters such as Adsorbent dosage, and Contact time are of vital importance. To ascertain the above parameters batch adsorption studies were conducted and the results are discussed below. Before studies for determine the efficiency of removal the characteristic of effluents.

1. *Effect of adsorbent dosage*

The main parameter affecting the adsorption is the concentration of adsorbent, because the adsorbent dosage helps to determine the capacity of adsorbent for the given initial concentration of metal solution. The effect of the adsorbent on the adsorption process can be determined by a plot of %Removal vs Adsorbent dosage for effluent. For the study 500mg/l solutions are adopted. From the curve it is found that the adsorption increases with the increase of adsorbent dosage for solutions. It is because of the increased adsorption surface area of adsorbent. But the adsorption increases up to an optimum amount of adsorbent and then decreases. The optimum amount of almond shell powder is 8g, 2.5g for RHA, 3g for sawdust.

Removal efficiency of methyl orange by almond shell is given in the table.1

Table .1almond shell removal %

Absorbent dosage (g)	Removal (%)
2g	41.6
4g	45.2
6g	75.5
8g	81.9
10g	88.2

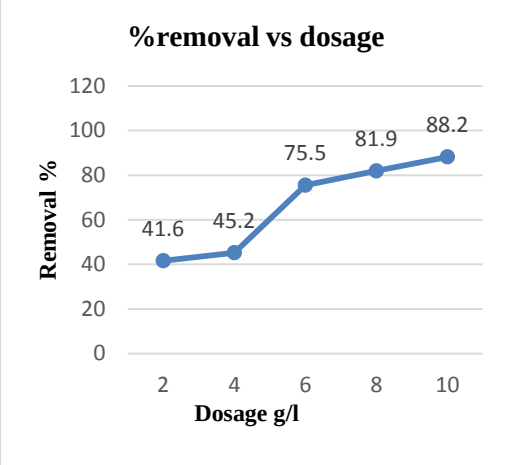

Fig .3Almond shell removal vs dosage

Table .2 Rice husk ash % removal

Absorbent dosage (g)	Removal (%)
1g	66
1.5g	78
2g	94
2.5g	97
3g	88.2

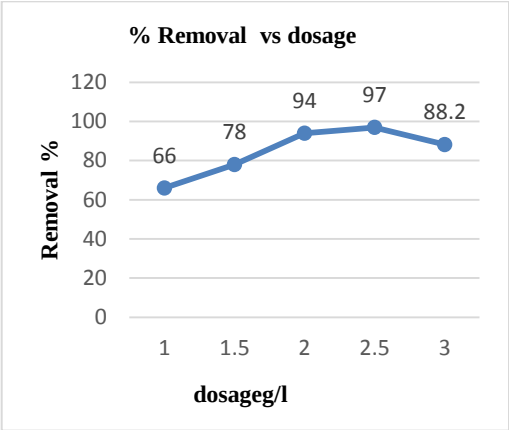

Fig 4: RHA % removal vs dosage

Table.3 Saw dust Absorbance %

Absorbent dosage (g)	Adsorption (%)
1g	0.012
1.5g	0.018
2g	0.026
2.5g	0.046
3g	0.060

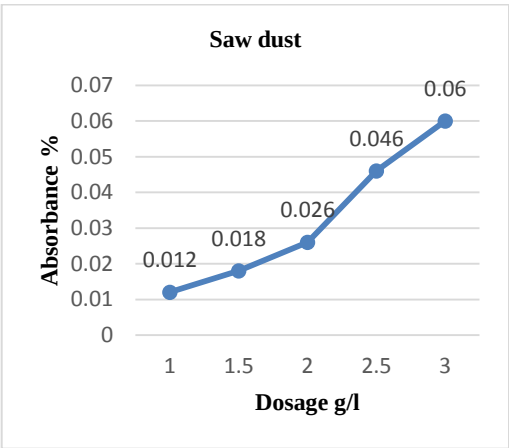

Fig.5% Absorbance vs different absorbent dosage of sawdust

Table. 4 % combination of materials

Absorbent dosage (g)	Removal (%)
2g	20
4g	31
6g	56
8g	67
10g	89
12g	93
14g	95

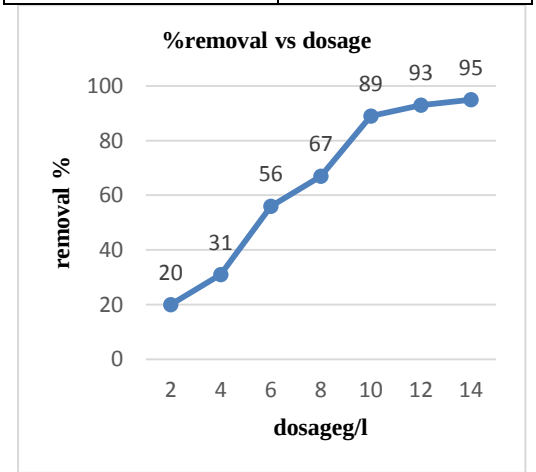

Fig.6% removal vs dosage

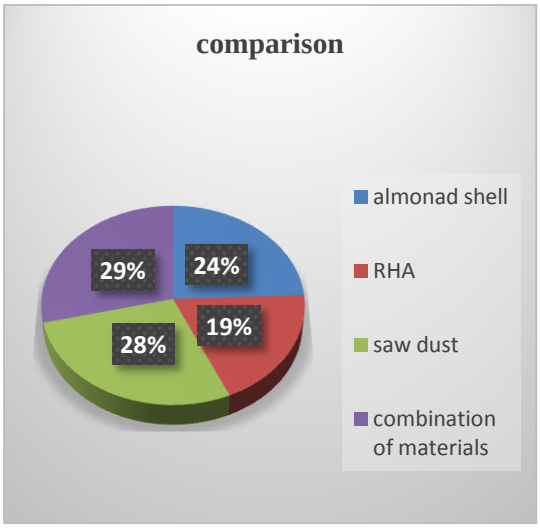

Fig.7% Absorbance vs different absorbent dosage comparison

2 Effect of contact time

The contact time is a major factor affecting the adsorption. The effect of contact time is determined by time intervals with different adsorbent dose. The plot between the % Removal and the contact time shows the variation in adsorption with the increase of time. From the graph it is found that the adsorption increases gradually with the increase of contact time.

Table. 5Almond shell removal % in different time

Time (min)	Removal (%)
30	31
60	36
90	45.6
120	47.1
150	49
180	41

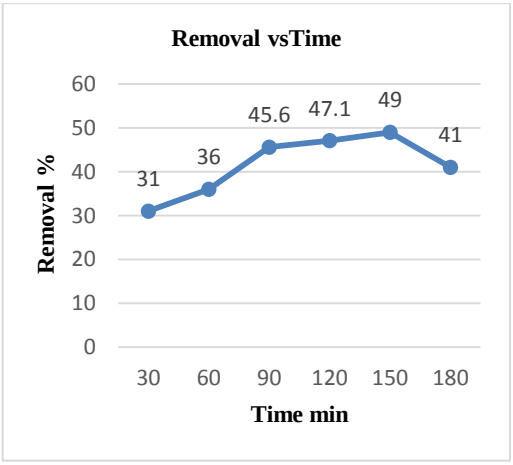

Fig.8Almond shell removal % in different time

Time (min)	Removal (%)
30	30
60	90
90	91
120	96
150	93
180	89

Table.6 rice husk ash % in different time

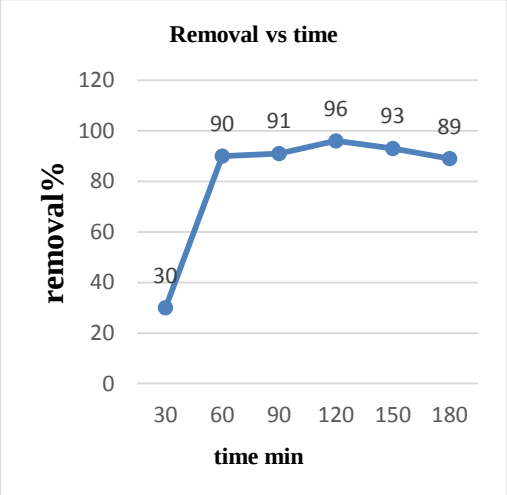

Fig .9 RHA % Removal vs time

Time (min)	Removal (%)
30	20
60	37
90	49
120	61
150	67
180	70

Table.7 Sawdust % in different time

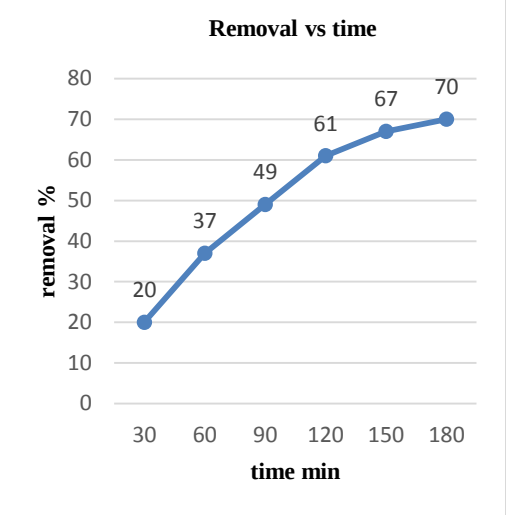

Fig.10 Saw dust removal vs time

Time (min)	Removal (%)
30	15
60	32
90	57
120	59
150	67
180	95

Table.8:% combination of materials

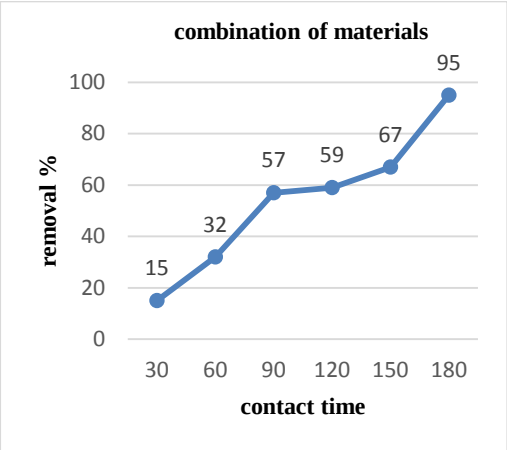

Fig.11removal vs time

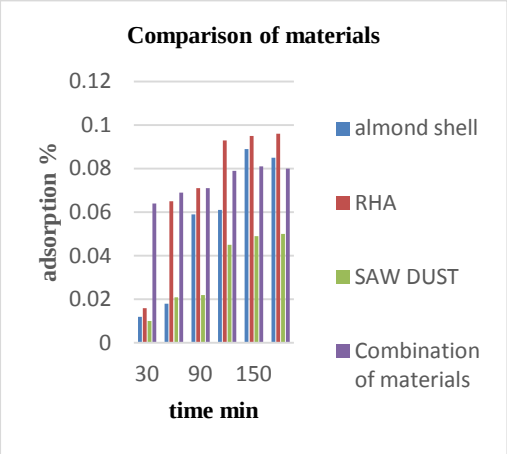

Fig.12comparison of materials according to the contact time

1V CONCLUSION

Almond shell, rice husk ash, saw dust are an environmentally friendly potential adsorbent for dyes. And also can reduce the waste materials from the surroundings through this kinds of works.

The amount of adsorbent is a factor depending the adsorption. The adsorption increases with increase of the amount of the adsorbent used. But at after an optimum amount of adsorbent the adsorption gets decreased. The increase of the adsorption is due to the availability of lager adsorbing sites and contact area on the adsorbent. Thus better removal efficiencies are obtained at an increased amount of adsorbent. The optimum amount of adsorbent is obtained as 10g for almond, 2.5g for RHA, 3g for saw dust but for the combination for materials the optimum amount adsorbent is14g.

The adsorption of the dyes depends on the contact time. The adsorption increases with the increase contact time with the adsorbent. Thus the removal efficiency also increases. The adsorption rate of almond shell is 82.6%,RHA is 86.6%,saw dust remove the dark colour of the effluent to light colour, but the combination of materials give more adsorption efficiency in both factors is 90.7%.The characteristics of effluent changed the pH changed and also bod and cod become limited, so treated water is capable for agricultural purpose.

The use of Rice husk ash, sawdust and almond shell are natural adsorbent removes from the effluent. It can also be used as an adsorbent for the removal of other types of dyes in the waste water. And adsorption efficiency can determine by other factors like pH, concentration of the effluent.

REFERENCES

[1] FatihDenizet. al, “Adsorption] Properties of Low-Cost Biomaterial Derived from Prunusamygdalus L. for Dye Removal from Water”. The Scientific World Journal 2013.

[2] Nitin P. Khatmodeet. al, “Removal of pH, TDS, TSS &Colour from Textile Effluent by Using Sawdust as Adsorbent”. International Journal of Sciences: Basic and Applied Research (IJSBAR) (2015) Volume 24, No 2, pp 158-163.

[4] Milind R.Oidde1 et. al, "Comparative adsorption studies on Activated Rice Husk and Rice Husk Ash by using Methylene Blue as dye". International Journal of Sciences: Environmental research at bits Pilani Goa 2016.

[5]Harpreet Kaur et. al, "Removal of dyes from textile industry effluent". SSRG International Journal of Humanities and Social Science (SSRG-IJHSS) – EFES April 2015.

[6]V. M. Sivakumaret. al, "Colour Removal of Direct Red Dye Effluent by Adsorption Process Using Rice Husk". International Journal of Bioscience, Biochemistry and Bioinformatics, Vol. 2, No. 6, November 2012.

[7] Rana Rahman et. al, " Degradation of methylene blue in textile waste water using activated sawdust and egg shell biosorbent". IJARIIE-ISSN(O)-2395-4396 Vol-2 Issue-4 2017.

[8] EdrisBazrafshanet. al, "Adsorptive Removal Of Methyel orange and reactive red 198 dyes by Moringaperegrina ash ". *Indian journal of chemical technology*, vol. 21, march 2014.

[9] M Joshi et. al, "Colour removal from textile effluent". *Indian journal of fibre and textile research*,vol.29,march 2004.

[10] K. S. Bharathiet. al, "Removal of dyes using agricultural waste as low-cost adsorbents: a review". *Indian journal of fibre and textile research*,vol.29,july 2013.

Sahla.c received B.tech degree in civil engineering from Jct College of Engineering and Technology, in 2017 and currently pursing M.tech environmental engineering from Malabar College of Engineering and Technology

Anitha.Kreceived M.tech degree in environmental from Govt Engineering college Thrissur, currently working as a assistant professor in Malabar College Engineering and Technology