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# Evaluation of efficiency in congored dye removal - By casurina leaves in two different approch

**E. Kowsalya*, S. Sharmila and L. Jeyanthi Rebecca**

*Department of Industrial Biotechnology, Bharath University, Chennai*

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**ABSTRACT**

*The objective of this work is the study of adsorption of dye solution which is a phenol red using low cost adsorbent Casuarinas fresh leaf (sample I) and Casuarinas dried leaf (sample II). Removal of phenol red dye from aqueous solution using these two adsorbents has been investigated. Liquid phase adsorption experiments were conducted. Batch adsorption studies are carried out by observing the effect of experimental parameters namely adsorbent dose, initial dye concentration, time agitation and effect of pH. In present study it was observed that adsorption of initial dye concentration 700mg/L solution showed ,17% adsorption in adsorbent (I) whereas 14% in adsorbent(II). The maximum adsorption observed was 40% with 1gm adsorbent (I) dose, (for the same concentration 700mg/L of dye solution at same condition. The Effect of Time of 100 min contact time for same condition of 700mg/L & 3gm adsorbent dose showed not much difference as adsorbent (I) gives 22% & adsorbent (II) gives 25% adsorption. Since this initial dye concentration of phenol red is acidic dye pH variation of 7, 7.5, 8.5 showed negative value.*

**Keywords:** Adsorption,, Casurina, adsorbent, efficiency, congo red dye.

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## INTRODUCTION

A huge amount of Water is necessary by industries for the cleaning and washing purposes and they discharge highly colored chemicals, effluent containing different dyes. It was estimated that 10-20 % of dye was lost during the dyeing process and released as effluent . Due to their chemical structures, dyes are resistant to fading on exposure to light, water and many chemicals and, Therefore, are difficult to be decolorized once released into the aquatic environment [1]. Research is being carried out for removal dyes using physicochemical, chemical and biological treatment technologies, such as chemical coagulation–flocculation, membrane-based separation processes [2], The release of large quantities of dyes into water by textile industries possesses serious environmental problems [3] due to its persistent nature. The coloured effluent have an inhibitory effect[4] on the process of photosynthesis and affecting aquatic eco system. Azo dye like congo red not degradate completely produces toxic amines in water [5]. Dyes have a tendency to produce metal ions in textile water produces micro toxicity in the life of fish [6]. Thus the removal of dyes from coloured effluents in textile industry is one of the major environmental problem. There are various methods which have been employed for removal of dyes from effluent [7]. Most of these methods are expensive. The adsorption process [8] has been found to be more effective method over all other treatments. Therefore proposed work were undertaken using agriculture waste like saw dust for the removal of dye material [9-11] from aqueous solution. Various other non-conventional adsorbents like fired clay, silica [12]biogas residual slurry[13], Fe3+/Cr3+ hydroxide sludge[14], China clay [15], peat moss and rice hulls [16], coconut husk [17] and fly ash [18]; [19], groundnut shell and tea waste [20] have also been reported as efficient adsorbents in removing colour In the work of Searchig for the new waste material for treating congo Red dye effluent the idea of use of

casurina leaves as a adsorbent was arised. Casuarina' is from the Malay word 'kasuari', from the supposed resemblance of the twigs to the plumage of the cassowary bird. One of the common names of Casuarina species, 'she-oak', widely used in Australia,refers to the attractive wood pattern of large lines or rays similar to oak but weaker products.so the the present study was to use Casurina leaves as a adsorbent material was going to carry out. By two different Approach one using Fresh leaves and the other one, treating with dried leaves.

## MATERIALS AND METHODS

**Preparation of adsorbent:**

Initially casuarinas leaves were collected from fresh casuarinas tree and leaves were washed with tap water again washed with distilled water for 3-4 times to remove other contaminants. Leaves were then dried in sunlight for 5 days leaves were crushed and passed through 40 mesh size sieve to get uniform particle size distribution of raw casuarinas leaves adsorbent. The prepared adsorbent was stored in bottles for further use. The dry leaves collected directly from tree and leaves were washed with tap water again washed with distilled water for 3-4 times to remove other contaminants. Leaves were then dried in a hot air oven at 80c for 48 hours. Leaves were crushed and passed through 40 mesh size sieve to get uniform particle size distribution of raw casuarinas leaves adsorbent. The prepared adsorbent was stored in further use.

**Fig1: FRESH LEAVES**

**Fig2: DRIED LEAVES**

**Preparation of Adsorbate:**

A stock solution of phenol red was prepared by dissolving 0.7g of phenol red dye in 1L of distilled water by constant stirring a magnetic stirrer at 400 rpm and 80c for 1 hour for complete mixing. The solution is then cooled and filtered to get the clear stock solution and this is stored for furtheruse.

**Batch adsorption studies:**

The effect of initial dye concentration, adsorbent dose and contact time of agitationof adsorbate were studied using 100 mL of phenol red dye solution in 250 mL standard conical flasks and required amount of adsorbents were added to each flask. The solutions were agitated at a constant speed and temperature using Secor India Griffin Flask Shaker. After agitation the solutions were centrifuged at 7000 rpm for 15 minutes to remove colloidal materials. Then the absorbance of the supernatant solution was found out using Systronics Photoelectric Colorimeter 114, to estimate the final dye concentration at 315 nm and 515 nm since methyl red absorbs light of two different wavelengths (George *et al.*, 2007). The percentage removal of adsorbate adsorbed on the adsorbent is given as,

$$\% \text{ Dye removal} = ((C_0 - C_f)/C_0) * 100 \quad \text{----------(1)}$$

Where,

Co , $C_f$ = Initial ,Final concentration of dye (mg/L)

**Effect of initial dye concentration:**

For this aliquots of stock phenol red solution (300 mg/L – 700mg/L) were taken in 5 conical flasks and 3g of adsorbent was added to each flask. These were kept in the shaker for 100 minutes. After agitation the solutions were centrifuged at 7000 rpm for 15 minutes to remove colloidal materials. Then the absorbance of the supernatant solution was found to estimate the final dye concentration. The amount of phenol red adsorbed per unit weight of adsorbent was calculated as

$Q= ((C_0-C_f)*V)/W)$ mg/g ----------(2)

V=Volume of solution, W=Weight of adsorbent

**Effect of adsorbent:**
For this 700 mg/L of stock phenol red solution w taken in 5 conical flasks and 1, 1.5, 2, 2.5, 3g of adsorbent was added to each flask. These were kept in the shaker for 100 minutes. After agitation the solutions were centrifuged at 7000 rpm for 15 minutes to remove colloidal materials. Then the absorbance of the supernatant solution was found to estimate the final dye concentration

**Effect of time of agitation:**
For this 700 mg/L of stock phenol red solution were taken in 5 conical flasks and 3g of adsorbent was added to each flask. These were kept in the shaker for different time intervals of 20, 40, 60, 80 and 100 minutes. After agitation the solutions were centrifuged at 7000 rpm for 15 minutes to remove colloidal materials. Then the absorbance of the supernatant solution was found to estimate the final dye concentration.

**Effect of pH:**
For this 700mg/L of stock phenol red solution were taken in 12 conical flasks, 6 for fresh leaves and 6 for dried leaves adsorbents. The pH of 3 flasks was adjusted to acidic range (3.5-5.5) by adding 1N Hcl and 3g of adsorbent was added to each flask. Similarly, the pH of another set of 3 flasks was adjusted to alkaline range (7.5-9.5) by adding 1N NaOH and 3g of adsorbent was added to each flask. These were kept in the shaker for fixed time intervals of 100 minutes. After agitation the solutions were centrifuged at 7000 rpm for 15 minutes to remove colloidal materials. Then the adsorbance of the supernatant solution was found to estimate the final dye concentration.

## RESULTS AND DISCUSSION

### EFFECT OF INITIAL DYE CONCENTRATION:

**Table 1: Effect of initial dye concentration on adsorption with at a constant adsorbent dose 3 g**

| S.NO | CONCENTRATION | % DYE REDUCTION | |
|---|---|---|---|
| | | FRESH LEAVES | DRIED LEAVES |
| 1 | 700mg/L | 17 | 14 |
| 2 | 600mg/L | 16 | 11 |
| 3 | 500mg/L | 12 | 10 |
| 4 | 400mg/L | 10 | 8 |
| 5 | 300mg/L | 6 | 6 |

The adsorption and dye reduction (%) for fresh and dried leaves shows the above values from adsorption co efficiency. these values are compared and are graphed.

By the concentration change at constant time intervals the difference in dye removal was noted and it was plotted as graph. In which the 300mg/L showed 6% adsorption, 400mg/L showed 10% adsorption gradually increased and finally 700mg/L showed 17% adsorption. The adsorption efficiency showed gradual increased at 700mg/L concentration constant for casuarinas fresh and dried leaves**.**

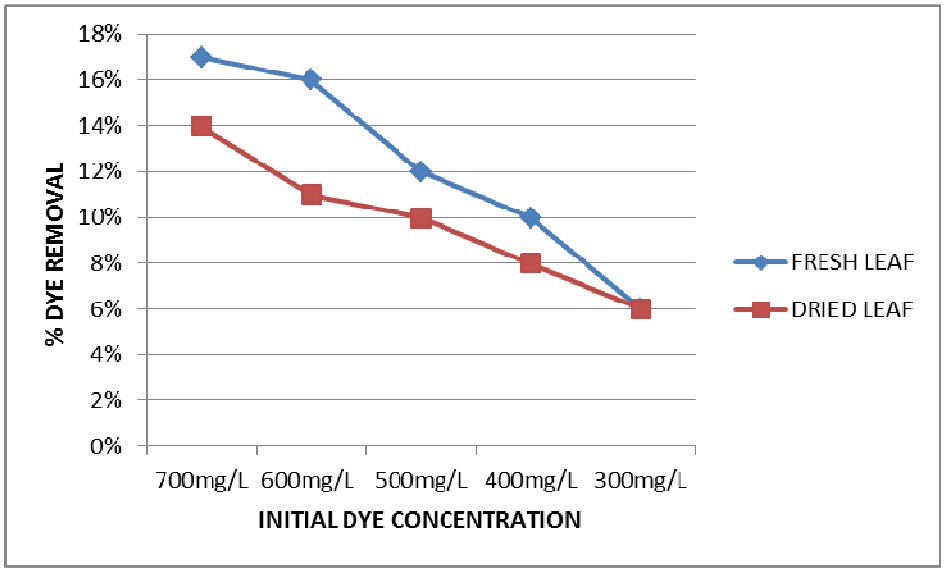


**Fig 3: Effect of initial dye concentration on adsorption with at a constant adsorbent dose 3 g**

## EFFECT OF ADSORBENT DOSE:

Table 2**: Effect of Adsorbent Dose on Initial Dye Concentration of 700 mg/L on Adsorption**

| S.NO | AMOUNT OF ADSORBENT(g) | % REDUCTION | |
|---|---|---|---|
| | | FRESH LEAVES | DRIED LEAVES |
| 1. | 1 | 40 | 38 |
| 2. | 1.5 | 21 | 22 |
| 3. | 2 | 18 | 20 |
| 4. | 2.5 | 17 | 14 |
| 5. | 3 | 16 | 12 |

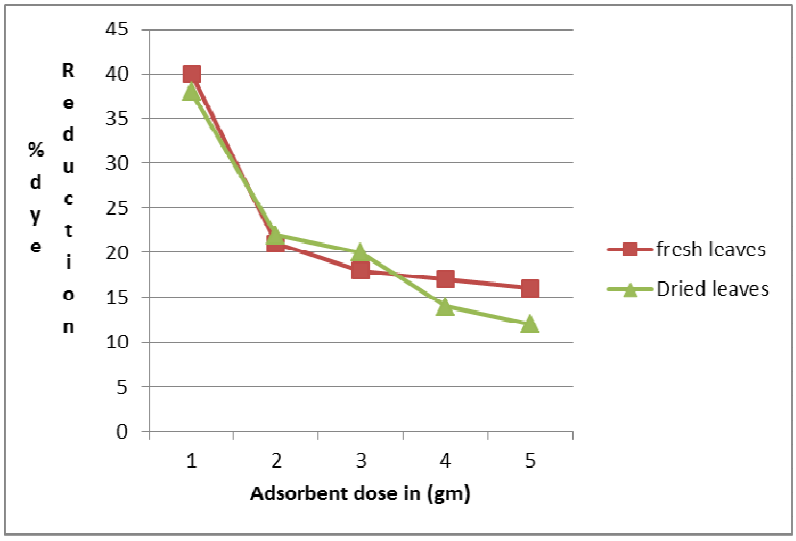


**Fig 4: Effect of Adsorbent Dose on Initial Dye Concentration of 700 mg/L on Adsorption**

Keeping the concentration at grams the adsorption y was found from the graph as follows, casuarinas fresh and dried both would be show gradual decrease. Mainly the fresh leaf only shows highest adsorption efficiency.

**EFFECT OF TIME:**

**Table3: Effect of Time on Initial Dye Concentration of 700 mg/L on Adsorption with at a constant adsorbent dose of 3 g**

| S.NO | TIME(min) | % REDUCTION | |
|---|---|---|---|
| | | FRESH LEAVES | DRIED LEAVES |
| 1. | 20 | 1 | 2 |
| 2. | 40 | 5 | 6 |
| 3. | 60 | 8 | 9 |
| 4. | 80 | 14 | 23 |
| 5. | 100 | 22 | 25 |

The effect of time interval on dye reduction for fresh and dried leaves is tabulated above**.**

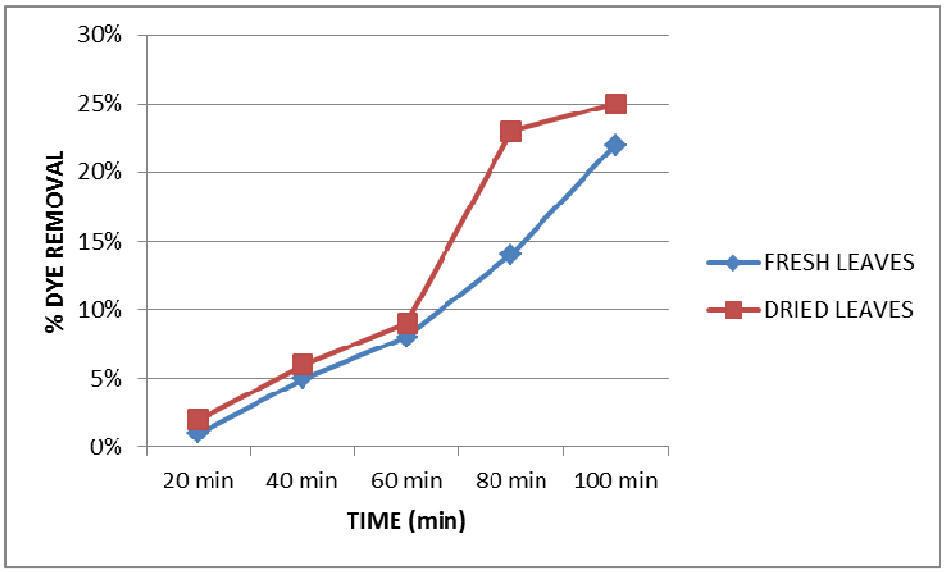


**Fig 5: Effect of Time on Initial Dye Concentration of 700 mg/L on Adsorption with at a constant adsorbent dose of 3 g**

Keeping the concentration how the time intervals were changed and the graph was plotted. The adsorption efficiency gradually increased fresh leaf from 1% to 22%, dried leaf from 2% to 25%.The dried leaf only showed highest adsorption efficiency than others.

**EFFECT OF pH :**

**Table 4: Effect of pH on initial dye concentration of 700mg/L on adsorption with at a constant adsorbent dose 3g**

| S.NO | pH | % REDUCTION | |
|---|---|---|---|
| | | FRESH LEAVES | DRIED LEAVES |
| 1. | 3.9 | 14 | 12 |
| 2. | 4.00 | 21 | 17 |
| 3. | 4.10 | 25 | 23 |
| 4. | 7.5 | -35 | -37 |
| 5. | 8.00 | -37 | -40 |
| 6. | 8.5 | -45 | -50 |

The effect of ph on dye reduction % for fried and dried leaves are calculated from the adsorption co-efficiency and tabulated.

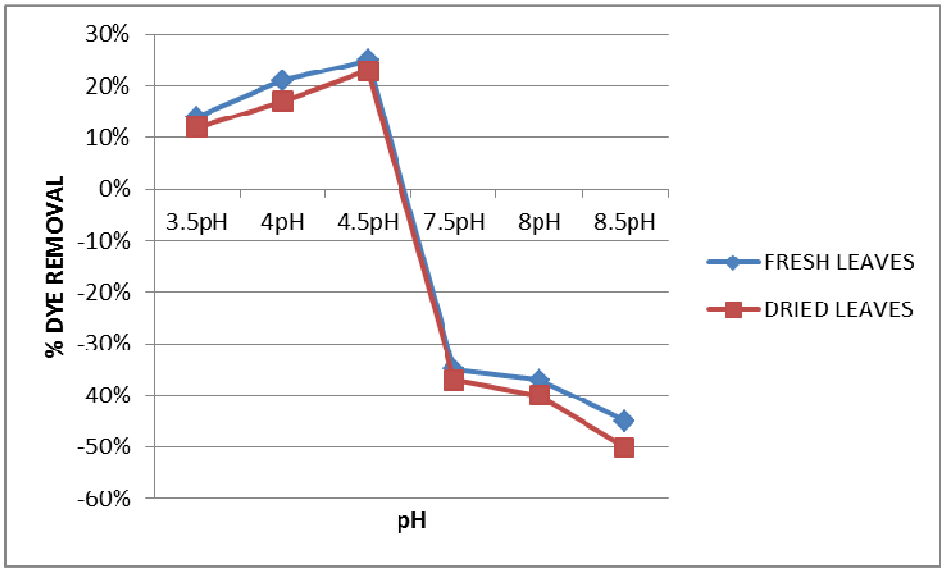


**Fig 6: Effect of pH on initial dye concentration of 700mg/L on adsorption with at a constant adsorbent dose 3g**

The efficiency of adsorption is dependent on the pH of solution since variation in pH leads to the variation in the surface properties of the adsorbent and the degree of ionization. The pH variation over the pH range of 3.5 to 8.5 for both fresh and dried leaves adsorbents. It is observed that the percentage removal decreases with increase in pH for both adsorbents. The maximum dye removal was 25% for fresh leaves. Hence it can be conclude that the acidic range of dye is favourable with both adsorbents.

## CONCLUSION

Adsorption is operative in most natural physical, biological, and chemical systems, and is widely used in industrial applications such as treatment of effluents, purification of water etc., In this study, low cost and easily available sources were chosen as adsorbent and it's efficiency were analyzed. The casuarinas fresh and dried leaves powder was used as adsorbent for the phenol red dye. Since it is not showing very high efficiency in future to improve the dye adsorption efficiency It has been decided to convert it into activated carbon and to charaterise its properties and test the adsorption on dye reduction of various other dyes.

## REFERENCES

[1] J Sharma, B Janveja , J Rasayan, *Chem*, **2008**, 1(4), 936-942.
[2] M K Purkait, S DasGupta, S De, *J.Hazardous Materials*, **2006,**136, 972-977.
[3] G Mcmullan, C Meehan, A Conneely, N Kirby ,T Robinson *Appl Microbiol Biotechnol* **,2001** , 56, 81-7.
[4] P Nigam, G Armour , I M Bonant , D Singh, R Marchant, *Bioresour Technol*,**2000** 72, 219-226.
[5] N L Wolfe ,E Weber , *Environ. Toxicol Chem*, **1987**, 6,911-927.
[6] G K Nagda , A M Diwan , V S Ghole, *App. Eco. & Enviro*,Res. **2007,** 2 , 1- 2.
[7] B K Singh, N S Rawat , *J. Chem. Techno. Biotechnol*, **1994,** 61 , 307-317.
[8] G McKay , G R Prasad , P R Mowli , *Water Air Soil Pollut***. 1986,** 29,273-283.
[9] S K Khare , K K Panday, R M Srivastava, V N Singh , *J Chem. Technol Biotechnol*, **1987,** 38 ,99-104.
[10] R S Juang , F C Wu , R L Tsang , *Environ. Technol.* **1997,** 18, 525-531.
[11] B K G Theng , N Wells , *Appl. Clay. Sci*,**1995** ,9 ,321-326.
[12] G Mckay, M S Otterburi , A G Sweeny,*Water Res.* **1980,** *14:* 21-27.
[13] C Namasivayam, R T Yamuna, *J Chern. Tech. Bio Tech*,**1992a**, 53 (In press).
[14] Namasivayam, C. and R.T. Yamuna. *Water, Air and Soil Pollution* **1992b**. 61 (In press)
[15] G S Gupta, G Prasad and V N Singh, *Ind Assoc Environ Management*,**1989**, 13 *j 1*6,174.
[16] S S Nawar, and H S Doma, *Sci. Total Envt***,1989,** 79,271.
[17] K S and C K lee, *Pe1tanika* **1990**,13,221-228.

[18] S K Khare, K K Panday, R M. Srivastava,V Singh. *J Che1n Tech. Bio Tech*,**1987**, 38, 99-104.
[19] G S Gupta, G Prasad, K K Panday , V N Singh. *Water& Air and Soil Pollution*, **1988**, 37,13-24.
[20] E Kowsalya, S Sharmila ,L Jeyanthi Rebecca, K Yogasri *Int. J. Pharm. Sci. Rev.* Res.**2015**, 31(1) 27, 132-134