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To cite this article: Subhashini Sankar and E. Kowsalya 2022 *IOP Conf. Ser.: Earth Environ. Sci.* 1125 012006

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# Reduction of Dye component level by using the waste based materials- Groundnut shell powder and Neem seed powder

Subhashini Sankar\*, E. Kowsalya<sup>1</sup>

Subhashini Sankar\*, Assistant Professor, Department of Petroleum Engineering, VISTAS,  
Chennai, TamilNadu, India

\*Corresponding Author [subhashini.se@velsuniv.ac.in](mailto:subhashini.se@velsuniv.ac.in)

E. Kowsalya<sup>1</sup>, Assistant Professor, Department of Industrial Biotechnology, Bharath University,  
Chennai, TamilNadu, India

## ABSTRACT

Methylene blue dye discharged from the textile industries is a thiazine dye which is toxic and non-degradable chemical. Activated carbon is mostly used adsorbent to effectively remove Methylene blue from industrial waste waters. Low-cost adsorbents like groundnut shell powder and neem powder were used for the dye component level present in a solution as batchmode treatment for the Methylene blue concentration of 200mg/litre and fixed adsorbent concentration of 0.5 grams Adsorbent I (Neem seed powder) have an excellent adsorption capacity of 85% where as for the same process condition, Adsorbent II (Groundnut shell powder) showed only 15% adsorption. The Effect of contact time on Adsorbate (Methylene blue) concentration removal data obtained for the both adsorbent I & II shows linear increase of percent removal capacity. For adsorbent I it shows maximum of 95% in 100min for adsorbent II 80 % is the maximum Percent removal.

**Keywords:** *Adsorption, Neem seed powder, Groundnut shell powder, Methylene Blue Dye, Adsorbent, Textile effluent, Water souluble dyes, Adsorbate, Agitation,*



## 1. INTRODUCTION

Waste Water treatment is the major important process to be taken in account for any kind of industries .Every industries are letting out the waste in form of water comprising of different variety of chemical,biochemical components which is huge threat to the environmental conditions. Among this dye industries are very larger in India as very small scale to large scale size of textile industries the dye used for the fabrics are toxic in nature they are classified widely for example anionic-dye ,Cationic-dye. Some industries are tends to follow the illegal disposal of waste water directly in to water sources near the industries. Almost ten to fifteen percentage of dye is coming out as waste along with the waste water from the total percentage of dye used. textile effluents. The main treatment process for dye water is adsorption process as it is more effective,and simple to operate and maintain. It will be using the adsorbent material called Activated carbon. Commercially the amount to be spent for the adsorben is quite costly so if there is any adsorbent available in lesser cost than commercial Activated carbon means it will encourage to adopt dye treatment step by all the industries at affordable expense based on this requirement the work of done to use the material which was just thrown as waste from the household to turn in to valuable adsorbent here the work was carried out with the Groundnut shell and Neem seed powder to treat methylene blue dye waste water solution.

## 2. MATERIALS AND METHODS

### Preparation of Adsorbent

First Neem seeds were separated from its fruit and then washed thoroughly with hot water one until the visous layer was fully washed out from the seed then kept for drying under sunlight for4-5 days.then it was grinded in to powder after sieved for the required size. Then was stored in a dry

container .similarly the groundnut shell were treated and finlly prepared as another adsorbnet material.



**Fig 1: Groundnut shell powder**



**Fig 2: Neem seed powder**

### **Preparation of Adsorbate**

The stock solution of methyleblue was prepared with 0.5 gram in one liter of solution.from the stock solution various other concentration of methylene blue dye solution were prepared then it was subjected to the further process steps.

### **Batch Adsorption Studies**

Adsorption was carried out by taking the different concentration solution of adsobate of 100 milliliter in a five conical flask and to each conical flask one gram of prepared adsorbent were added and kept for medium speed of rotation at constant level the adsorption was started .the adsorption timing was fixed as required time interval.Once the time reached the conical flask solution were centrigued at 10000 rpm for 10 min,the supernatant solution was filterd and observed for the Optical Density value using a Colorimeter at particular wavelength (George *et al.*, 2007). The reduction level of methylene blue dye was found by the calculation below.

$$\% \text{ Dye removal} = (O.D^{\circ} - O.D^{\textcircled{1}}) / O.D^{\circ} * 100 \text{ -----(1)}$$

Where,

$O.D_0$  = Initial Optical Density value solution before adsorption (mg/L)

$O.D_{(1)}$  = Final Optical Density value solution before adsorption (mg/L)

### Effect of Initial Dye Concentration

The various concentration of methylene blue solution was taken in a conical flask the value of adsorbance can be plotted for the use of standard graph and then it was subjected for adsorption process with the prepared adsorbents. The final OD (Optical Density) value can be correlated with the standard graph prepared to find the concentration after the treatment process. The rate of adsorption was calculated as,

$$Q = ((C_0 - C_f) * V) / W \text{ mg/g} \text{ -----(2)}$$

Where,

$C_0$  = concentration of dye before treatment (mg/L)

$C_f$  = concentration of dye after treatment (mg/L)

$V$  = Total Volume of conical flask solution (L)

$W$  = Amount of adsorbent added (g)

### Effect of dosage of Adsorbent

From the first step of work the initial concentration was fixed as 300 mg/L of methylene blue and it was taken in all five conical flask then adsorption study was carried out with different amount of adsorbent dosage.

### Effect of Time of Agitation

Similarly in this steps the adsorption study was carried out but for fixed initial concentration and adsorbent dosage but for different interval of time.

### RESULT AND DISCUSSIONS:

#### EFFECT OF INITIAL DYE CONCENTRARIION:

Table 1: Effect of initial dye concentration on adsorption with at a constant adsorbent dose 0.5 g

S.NO	Adsorbate Concentration (mg/l)	Adsorbent I	Adsorbent II
		%Reduction	%Reduction
1.	100	70	30
2.	200	85	15
3.	300	76	33
4.	400	75	43
5.	500	66	54

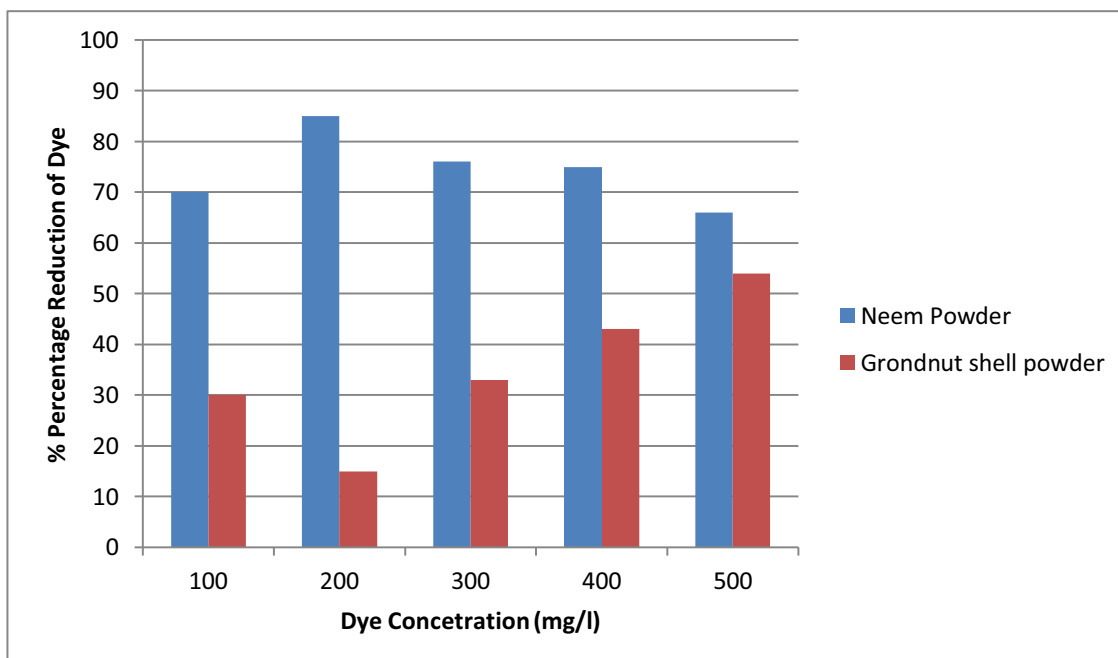


Fig.3 Effect of initial dye concentration on adsorption with at a constant adsorbent dose 0.5 g

By the concentration change at constant time intervals the difference in dye removal was noted and it was plotted as graph. In which the 100mg/L showed 70% adsorption, 200mg/L showed 85% this result is the maximum attained by the Neem seed powder adsorbent where as in some cases of preparation of adsorbent from neem leaf part was reported in the conference as the rapid percentage adsorption ranging from 69.44- upto 99.7 too with in 5-15 min (Muhammad B et al.,2015) but neem seed show some what 85% as maximum by analyzing the parameter study in various aspects it could be increased to 99%. The adsorption efficiency showed gradual increase and decreased finally at 500mg/L concentration constant for neem seed and for Groundnut as unusual increase & decrease from 29% to 15% then to 53%.

### **EFFECT OF ADSORBENT DOSE:**

**Table 2: Effect of Adsorbent Dose on Initial Dye Concentration of 500 mg/L on Adsorption**

S.No.	Adsorbent Dose(gm)	Adsorbent I	Adsorbent II
		%Reduction	%Reduction
1.	0.4	60	94
2.	0.5	66	86
3.	0.6	60	74
4.	0.7	66	52
5.	0.8	60	60

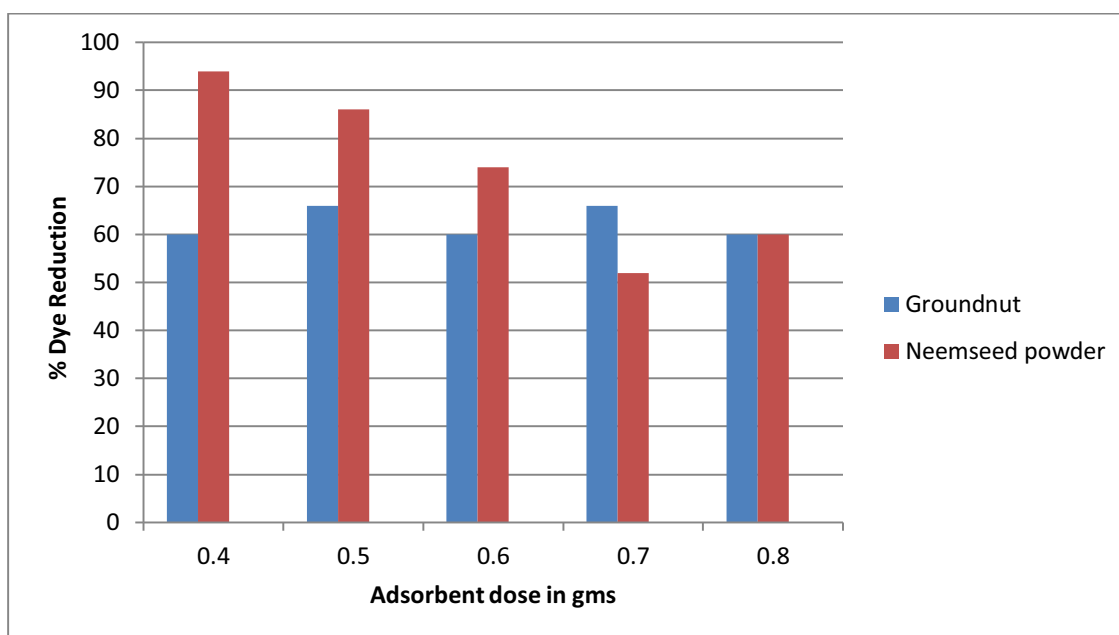


Fig 4: Effect of Adsorbent Dose on Initial Dye Concentration of 500 mg/L on Adsorption.

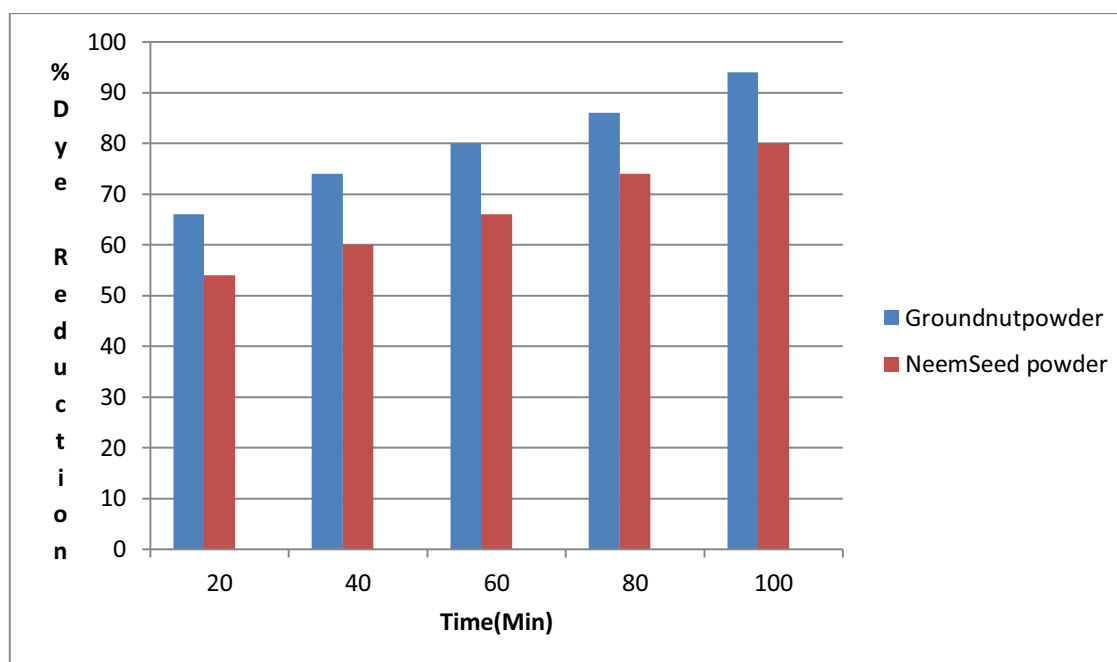
Keeping the concentration of Dye constant, the adsorption efficiency was found from the graph as follows, neem seed show gradual increase and decrease but reaches the initial stage at last from 60-60%. Groundnut shell starts from 93% to and drops down to 50% and suddenly increases to 60%. This is result is comparatively better than the another research work for the same ground nut shell powder in the removal of methylene blue which was reptred the adsorption percentage of 67,77,79 for bed height of 5,10,15cm in column study(sunil et al.,2013).

#### EFFECT OF TIME:

Table 3: Effect of Time on Initial Dye Concentration of 300 mg/L on Adsorption with at a constant adsorbent dose of 0.5 g

S.NO	TIME (min)	Adsorbent I	Adsorbent II
		%Reduction	%Reduction
1.	20	66	54
2.	40	74	60
3.	60	80	66
4.	80	86	74
5.	100	94	80





**Fig 5: Effect of Time on Dye Concentration of 300 mg/L on Adsorption with at a constant adsorbent dose of 0.5 g**

Keeping the concentration constant and change of time intervals graph was plotted. The adsorption efficiency increased linearly from from 65% to 85% for Neem seed. This result of rise in adsorption capacity is quite good when we compare with the work of Suthajini et al., in 2019 were it was reported from the treatment of Methylene blue dye with the adsorbent prepared from neem leaf, bark, seed as 83%, 80%, 69% respectively. the maximum adsorption was found with the leaf and minimum was found with the seed part but in present study the value of adsorption capacity showed better result of 85% when the time of contact get increased wher as Groundnut shell from 52% to 70% so it is evident that compared to Ground nut shell Neem seed adsorbents works effectively.

### 3. CONCLUSION

For the treatment of dye containing waste water so for several low cost adsorbents were found from the cheaper material as reported in the so many reviews(Dawood and Sen,2014;Mondal et al., 2018)in all of these the waste material such as the adsorbent prepared from the waste material of organic nature compounds such as peel,leaves and seed,bark were resulted as cost effective ,Ecofriendly adsorbents in such a way In this study, the material which were considered as waste is turned to useful adsorbents utilized for the waste water treatment that could be achieved at low cost and easily available sources .The adsorbent and its efficiency were analyzed. In future, the other parameters may also be optimized for getting better reduction in color and kinetics study will be carried out. We also have an idea to make use of this adsorbents wide in application to any other pollutants.

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