Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2017, 9(6):294-298

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Effect of Green Synthesis Clay Nano Composite Material on Reactive Dye of Methyl Orange

B Kamal *, V Parthiban, G Moha Priya and K Malathi

Civil Engineering Department, Sri Ramakrishna Engineering College, Coimbatore, Tamil Nadu, India

---

ABSTRACT

Textile is a leading industry of every country because of necessity of clothes and a textile industry plays a vital role in the industrial sectors and it consume lots of water for their usage as well as they dispose equal amount of wastewater with toxic dye contents. When textile wastewater is disposed to natural system, it creates major impacts to human as well as natural environment such as human related diseases, pollution of natural system etc., So, it is necessary to treat them effectively for the purpose of protection of Environmental condition and also to save humans and animal life. The Ocimum Tenuiflorum (Tulsi) leaves extract arbitrated green synthesis of silver coated nanoparticles (AgNPs) was used as an adsorbent for dye removal. The Silver Nano particles (AgNP) is characterised by the Particle Size Analyser. The adsorbent material is added to the dye solution at different proportions and shaked well in a conical flask shaker at different rpm. A centrifuge shaker is used to settle down the floating materials. The sample is then tested for spectrophotometer to find the absorption value and removal efficiency. These nanocomposite were found to possess moderate removal efficiency in comparison with soil as an adsorbent in the removal of reactive dye. Furthermore, using these Silver nanocomposites as an adsorbent helped in achieving about 51% removal of the methyl orange reactive dye from the effluent solution.

Keywords: Silver nanoparticles; Nanocomposites; Textile effluent; Methyl orange

---

INTRODUCTION

Dyeing industries is one of the leading growths of modernization and civilization area and its release enormous amount of toxic effluents with mixes of different concentration of chemicals. The chemical compounds degradation is very challenging task for now days and these effluents come out from dyeing industries create severe problems to human as well as surrounding environment. Disposal of toxic effluents of dyes are discharged directly to natural water systems without proper treatment, so that if affects ecology systems and result in an increased burden of health care issues in a developing country like India and worldwide. One of significant dye is Methyl orange are highly soluble in nature and thereby, the total quantity of dye in solution are create major impact to environment [1]. Nano science is an emerging technology for textile wastewater removal which can be dealing with synthesis, strategy and manipulation of particle's structure ranging from nearly 1 to 100 nm in size. All the physical, chemical and biological characteristics of any substances of both individual atoms and molecules can be changed within the Nano range. Novel applications of nanoparticles and nanomaterials are growing rapidly on various fronts due to their fully enhanced properties based on size, their scattering and morphology [2]. The Nano catalyst synthesis by various method and its applications in the food processing, packaging, medicine, antibacterial activity and waste water effluent treatment, however these applications are at in an elementary stage only. Research in Nanotechnology is estimated to have a huge impact on the development of new catalysts. The detailed understanding of Nanostructures and the ability to control size of materials will ensure a rational and cost efficient development of new and more capable catalyst. The environment has elegant and ingenious, in which most efficient reduced materials are available

for wastewater treatment. Green chemistry and use of green route for synthesis of metal nanoparticles lead a desire to develop environment-friendly techniques. Benefit of synthesis of silver nanoparticles using plant extracts is that it is an energy efficient, economical, cost effective; provide healthier work places and communities, protecting human health and environment leading to lesser waste and safer products. Now a day's Green synthesized silver nanoparticles are widely applied in nanotechnology field throughout the world. For the syntheses of nanoparticles employing plants can be advantageous over other biological entities which can overcome the time consuming process of employing microbes and maintaining their culture which can lose their potential towards synthesis of nanoparticles [3]. The main purpose of the research investigation is to study the characteristics of the reactive dye and also to decolorise them effectively by using the green synthesis process.

MATERIALS AND METHODS

The Tulsi leaf is collected from the nearby market and washed with water to remove the mud and other impurities. The Ocimum Tenuiflorum (Tulsi) juice was extracted from 15 gms of Tulsi leaves (Figures 1 and 2). After that Tulsi juice are kept in oven at 250**°**C and simultaneously prepared silver nitrate solution by dissolving 0.250 gms of silver nitrate crystal in 100 ml of distilled water [4]. The clay and red soil samples are collected from the nearby agricultural land and preliminary tests are conducted as per IS: 2720 procedure. The soil test results are mentioned in Table 1.

Figure 1: Tulsi leaf and its extract

Figure 2: Synthesized clay soil

Table 1: Physical characteristic of clay and red soil as per IS: 2720

S. No.	Description	Clay Soil	Red Soil
1	Moisture Content	8%	9%
2	Specific gravity	2.5	2.678
3	Free swell index	10%	12%
4	Liquid Limit	65 ml	60 ml

Particle size analysis, particle size measurement, or simply particle sizing is the collective name of the technical procedures, or laboratory techniques which determines the size range, and/or the average, or mean size of the particles in a powder or liquid sample. About 5 ml of Ocimum Tenuiflorum extract (tulsi) is mixed with 100 ml of silver nitrate solution [5]. It is then heated in muffle furnace for about 250°C. Then about 50 g of clay soil and red soil is sieved in 425 micron sieve. The solution is mixed with the soils and tested particle size analysis. Particle size of clay and red soil is 95.8 nm and 175.8 nm. Since, the particle size of the clay is observed to be 95.8 nm < 100 nm. So, it is confirmed that mixing of Ocimum Tenuiflorum juice, silver nitrate and clay soil composition as nano materials, thus result shown in Figure 3.

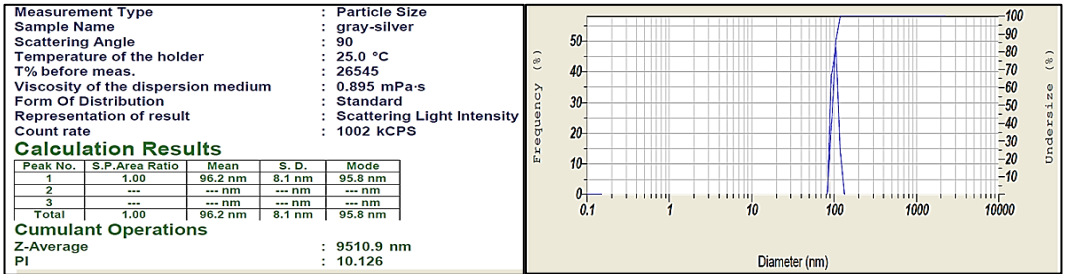

Figure 3: Particle size analysis result for mixing of tulsi, silver nitrate and clay

The textile dye of methyl orange is purchased from chemical industries and prepared synthetic dye solution. Among much reactive dye, methyl orange dye plays major role in industry for colouring the cloth fibres. Physical and chemical characteristics of dyes samples are mentioned in Table 2.

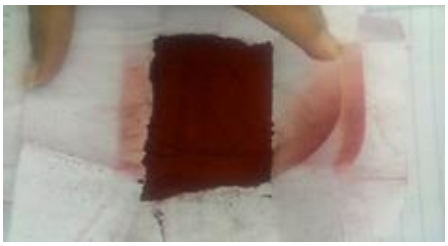

Figure 4: Methyl orange reactive dye powder

Table 2: Physical and chemical characteristics of dye samples

S. No.	characteristics	Methyl orange
1	pH	8.42 ppm
2	conductivity	2.3 mhos.
3	Turbidity	1.3 NTU
4	Liquid Limit	60 l

Mixed nano material can be used as an adsorbent to remove dye concentration. UV visible [6] spectrometer as an apparatus for measuring the intensity of light in a part of the spectrum, especially as transmitted or emitted by particular substances. Prepare the standard solution for 10, 20, 30, 40, 50, 60, 70, 80, 90 ppm in a SMF and calibrate the instrument by keeping blank solution in the cuvette by setting absorbance to 0 and transmission to 100%. Set the wavelength of methyl orange dye as 465 nm to maximum absorbance. Based on absorbance of standard solution, plotted the graph between concentration and absorbance as shown in Figures 4 and 5 [7]. Which has been used for unknown dye solution concentration, A mixture of dye sample of 20 ml and soil adsorbent of 1, 2, 3, 4 and 5 g are taken in the conical flask and placed in the shaker interval of 15 min and the rpm is set for 80, 140, 160 and 180 respectively.

Removal Efficiency = $(C_o-C_e) * 100 / C_o$

Where,

C_o = Initial dye concentration (mg/l)

C_e = Final dye concentration (mg/l)

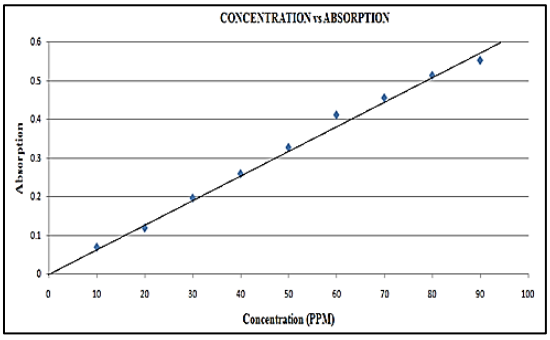

Figure 5: Calibration curve for standard solution

RESULTS AND DISCUSSION

Initial concentration of 20 ml of dye solution was taken and added adsorbent dose in the range of 1 g to 5 g which is placed in conical shaker at 180 rpm with 15 min interval of contact time, after that the dye solution placed in spectrometer and measured absorption and transmission values. 4 g of nano composite adsorbent removed 51% of methyl orange dye solution at 180 rpm and removal efficiency mentioned in Table 3. Maximum dye concentration has been removed at 4 g of adsorbent dose and it should be checked at 160 rpm. The maximum removal efficiency is 7% at 15 min interval of contact time and test results are mentioned in Table 4. For 140 rpm, the maximum removal efficiency is 14% as mentioned in Table 5. At slow speed of 80 rpm, the maximum removal efficiency is 9%, which less than removal efficiency of 14% at 140 rpm and these values are mentioned in Table 6. If the

adsorbent dose increases with increase of speed, removal of dye is high percentage in 15 min contact time. Figures 6 and 7 shows the adsorbent of synthesised nano composite material performance.

Table 3: Dye removal efficiency for 180 rpm at 15 min

Adsorbent(g)	Absorption	Transmission (%)	Concentration(ppm)	Removal efficiency (%)
1	0.495	31.9	75	25
2	0.335	46	52	48
3	0.333	46.2	50	50
4	0.329	46.8	49	51
5	0.503	31.2	77	23

Table 4: Dye removal efficiency for 160 rpm at 15 min

Adsorbent(g)	Absorption	Transmission (%)	Concentration(ppm)	Removal efficiency (%)
1	0.631	21.5	98	2
2	0.618	23.9	96	4
3	0.616	24.1	94	6
4	0.602	26.8	93	7

Table 5: Dye removal efficiency for 140 rpm at 15 min

Adsorbent(g)	Absorption	Transmission (%)	Concentration(ppm)	Removal Efficiency (%)
1	0.621	22.3	97	3
2	0.599	23.4	93	7
3	0.588	25.7	89	11
4	0.557	27.7	86	14

Table 6: Dye removal efficiency for 80 rpm at 15 min

Adsorbent(g)	Absorption	Transmission (%)	Concentration(ppm)	Removal Efficiency (%)
1	0.629	22.4	98	2
2	0.618	23.6	96	4
3	0.599	26.5	93	7
4	0.585	28.3	91	9

Figure 6: Before removal

Figure 7: After removal

CONCLUSION

The absorption performance of synthesized Nano clay soil studied effectively on uptake of methyl orange dye and it was concluded that the soil adsorbent acts as an effective sorbent for removal of methyl orange only. The optimum conditions for the removal of dye from aqueous solution of 20 ml was 15 min Contact time, pH of 8.42 mg/l, 4 g adsorbent dosage, 425 mincrons Sorbent size, Room temperature and Agitation speed of 180 rpm gives Maximum removal efficiency about 51%.

REFERENCES

[1] S Ahmed; M Ahmad; BL Swami; SA Ikram. *J Adv Res.* **2016**, 7, 17-28.
[2] C Shamik; S Papita. *J Environ Eng*. **2011**, 137(5), 388-397.
[3] P Banerjee; S Sau; P Das; A Mukhopadhyay. *Nanoscience Technol*. **2014**, 2-6.
[4] AH Jawad. *Desalination Water Treatment*. **2016**, 59, 210-219.
[5] S Kandasamy; RP Sorna; *Dept Food Technol.* **2015**, 7(3), 278-285.
[6] A Shakeel; M Ahmad; BL Swami; S Ikram. *J Radiat Res Appl Sci.* **2016**, 9(1), 1-7.
[7] H Bar; DK Bhui; GP Sahoo; P Sarkar; SP De; A Misra. *Colloids Surfaces A*. **2009**, 134-139.