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COLOURS REMOVAL USING IRON OXIDE NANO PAARTICLES

Ravi Yadav D[1], Manjunath. N. T[2], D P. Nagarajappa[3], Rashmi Shetty[4]

[1]M Tech student, Civil Engineering, UBDT College of Engineering, Davanagere, Karnataka, India
[2,3]Professor, Civil Engineering, UBDT College of Engineering, Davanagere, Karnataka
[4]Asst. Professor, Civil Engineering, UBDT College of Engineering, Davanagere, Karnataka, India

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Abstract - The dyes are used in many industries for coloring purpose. Because of its complex structure and synthetic form its difficult to treat hazardous. Many of the methods are used to treat color waste water that are adsorption, precipitation, reverse osmosis, coagulation.etc Among the mentioned methods absorption of color from nanoparticles is most advancing method and more efficiency compare to other adsorbents. In this study iron oxide nanoparticles were successfully synthesized by chemical method in order to remove the reactive green 19A and direct yellow 12 dyes from aqueous solution. To obtain optimum conditions on removal efficiency of dye and adsorbent dosage. According to the experimental results was observe that the Direct yellow 12 removal under neutral pH condition and reactive green 19A removal under alkaline pH conditions and both dyes are removal efficiency decreases with increase in initial concentration of color. In fact the removal of reactive green 19A was 99.99 % for iron oxide nanoparticle (Fe_2O_4 NPS) at pH 9, initial color concentration (C_0) 10 mg/L, adsorbent dosage 400 mg, at contact time of 80 min. For Direct yellow 12 removal efficiency was observe 99.9 % for Fe_2O_4 nanoparticles and 99.47 at pH= 7, C_0= 10 mg/L, Adsorbent dosage = 400 mg, at contact time of 80 min.

Key Words: Adsorption, Dyes, Reactive green 19A (RG 19A)Direct yellow 12 (DY 12) Iron oxide nanoparticles (Feo NPS)

1. INTRODUCTION

In recent years rapid growth of population and industrialization affects rapid am0unt of pollutants entering in to the water bodies. In these liquid pollutants of various types, Dye must be distinguished as serious problem because they were extremely use in so many textile leather and paper as well as cosmetics industries. Discharge of Dye water in to water bodies fr0m dying industries i.e. mainly in textile. It is solitary environmental problem, But it doesn't barely harm the physical natures of contaminated liquid, but it may affect on marine species current in the bionetwork by destructing light dispersion and transfer of oxygen. In adding up of various dyes may be degraded into other components (like soil, air), with toxic, mutagenic, and carcinogens, that may harms on living components also. Therefore, the removal of colour water from industries is more essential from wellbeing and ecological viewpoints before discharging into natural water bodies and ecosystem. [18].

1.1 OBJECTIVES.

1. To select the nanoparticles two to be used for experimentation.
2. To synthesis[preparation/activate]Nanoparticles.
3. To select the to assess their removal potential by nano particles.
4. To prepare synthetic color sample in the laboratory.
5. To fabricate bench scale setup [Batch] to be used for experimentation.
6. To evaluate treatment potential of color wastewater by Nanoparticles under varied

7. Experimental conditions.

2. MATERIALS AND METHODOLOGY

2.1 Adsorbent used and its Preparation:

- Method is as fallows adopted for synthesis of iron oxide nanopartcales.
- 0.03 mole of 5960 mg of Fecl2 was dissolved in 150 ml of distilled water and stirred strenuously using magnetic stirrer for 20 minutes.
- Precipitation was achieved by adding 100 ml of 1M of NaOH Solution drop wise while stirring.
- Initial pH of solution was observed as 3 and it is increased up to pH 12 by adding 1M NaOH.
- Then precipitation process was continued till un dark black color precipitate obtained.
- Then Fe3O4 precipitate formed was taken into centrifuge and centrifuged at 1500 rpm for 20 minutes.
- The centrifuge process was continued with water and two times with ethanol.
- Finely precipitate was dried. Which results in Iron oxide nanoparticalsI(Fe2O4) . [13]

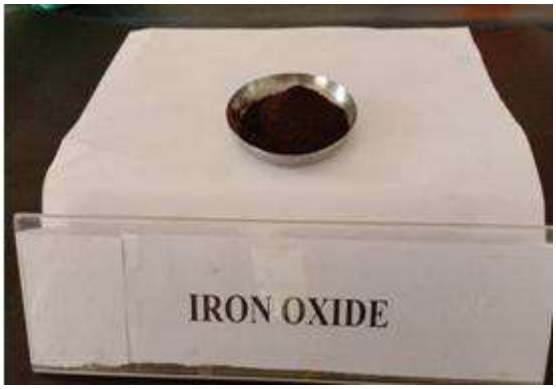

Plate 1: synthesized iron-oxide nanoparticle

2.2 Selection of Color and Preparation of Samples

For the color removal process in this present study the selected dyes were

- Direct Yellow 12
- Reactive green 19A.

Color Stock solution (1000 mg/L) produced by dissolving a measured quantity of Reactive green 19A and Direct Yellow 12 in distilled water. All working solutions prepared by diluting required quantity of stock solution in 1000 ml of distilled water (10 mg/L, 20 mg/L, 30 mg/ L,40 mg/ L). To adjust pH of the solutions Sodium Hydroxide (NaOH) and Hydrochloric acid(HCL) of 2N solution were added.

2.3 Experimental Procedure

For experimentation Jar test Apparatus has been used.

(Batch Studies)

1. For the performance of jar test initially four cleaned beakers of 1000 ml capacity has been taken.
2. In those beakers the color solutions of known quantity were taken and pH was adjusted.
3. Then to each beaker pre fixed quantity of adsorbents were added and agitated at 100 rpm To evaluate the influence of stirring time on removal efficiency, the samples were stirred for various contact times. After these time intervals samples were
4. collected and were analyzed by spectrophotometer
5. with specified wavelength for color removal efficiency.

2.4 Parameters Considered

Bird view of parameters considered for experimentation is presented in table 1

Table 1: Parameters Considered for Experimentation.

Sl.No	Parameters	Values
1	pH	5,7 and 9
2	Adsorbent Dosage	200 mg, 300 mg and 400 mg
3	Initial Concentration of Color	10, 20, 30 and 40 mg/L
4	Contact Time	20, 40, 60 and 80 min

ANALYSIS OF SAMPLES

The colour intensities of samples were determined by using spectrophotometer before and after adsorption process. To begin with, spectrophotometer was calibrated and adjusted for wave length of 630 nm (RG 19A) and 680.66 nm (DY-12). The calibration curve were drawn for known intensities of colour samples recorded in spectrophotometer. From the calibration curves corresponding to observed percentage adsorption the colour intensities of treated samples war determined.

Table 1: Experimental Finding with Adsorbent FeO NPs and Colour Reactive Green 19A at pH 9

SL.NO	Stirring time, min	Effluent clour concentration at stated adsorbent dosage, mg/l			Removal efficiency (%) at stated adsorbent dosage, mg/l		
		200	300	400	200	300	400
1	20	3.487	1.587	0.987	65.12	84.12	90.2
2	40	2.668	0.788	0.477	73.32	92.17	95.23
3	60	2.087	0.488	0.177	79.12	98.12	95.12
4	80	1.487	0.288	0.01	85.12	99.12	99.9

Table 2: Experimental Finding with Adsorbent FeO NPs and Colour Direct Yellow 12 at pH 7

SL.NO	Stirring time, min	Effluent clour concentration at stated adsorbent dosage, mg/l			Removal efficiency (%) at stated adsorbent dosage, mg/l		
		200	300	400	200	300	400
1	20	4.95	3.94	2.88	50.50	60.59	71.17
2	40	4.13	2.80	1.71	58.65	71.98	82.58
3	60	3.029	2.66	0.964	69.71	79.37	90.36
4	80	2.49	1.44	0.001	75.10	85.58	99.99

3.1 Effect of pH

Removal of RG 19A and DY 12 by MgONPs was conducted at varying pH of 5, 7 and 9. Better results obtained for decolorization of Reactive green 19A as pH increased from 5 to 9 and for Direct yellow 12 removal efficiency got increased as pH decreased from 9 to 7.

3.2 Effect of Initial Concentration

The lower and higher removal efficiency recorded at 10 and 40 mg/L respectively indicated that removal efficiency is a function of concentration of colour and is directly proportional.

3.3 Effect of Contact Time

To evaluate optimum time for maximum adsorption of RG 19A dye and DY 12 on MgO NPs, time varied from 20 to 80 minutes. The maximum colour removal efficiency for RG 19A was observed at 80 min above this a slight decrease in efficiency recorded, whereas for Direct Yellow 12 removal it was observed as contact time increased the removal efficiency got increased.

3.4 Effect of Adsorbent Dosage

Linear relationship between dosage and colour removalhas been obtained. It was observed as adsorbent dosage increased from 200 mg to 400 mg the removal efficiency also found to be increase. For Reactive Green 19A maximum [Adsorbent dosage 400 mg, pH 9, Co= 10 mg/L, Contact time t =80 min] and minimum [Adsorbent dosage 200 mg, pH 5, Co= 40 mg/L, Contact time t =20 min] removal efficiency recorded were found to be 99.99 % and 38.2 % respectively. For Direct yellow 12 maximum [Adsorbent dosage 400 mg, pH 7, Co= 10 mg/L, Contact time t =80 min] and minimum [Adsorbent dosage 200 mg, pH 9, Co= 40 mg/L, Contact time t =20 min] removal efficiency recorded were found to be 99.9 % and 45.3 % respectively.

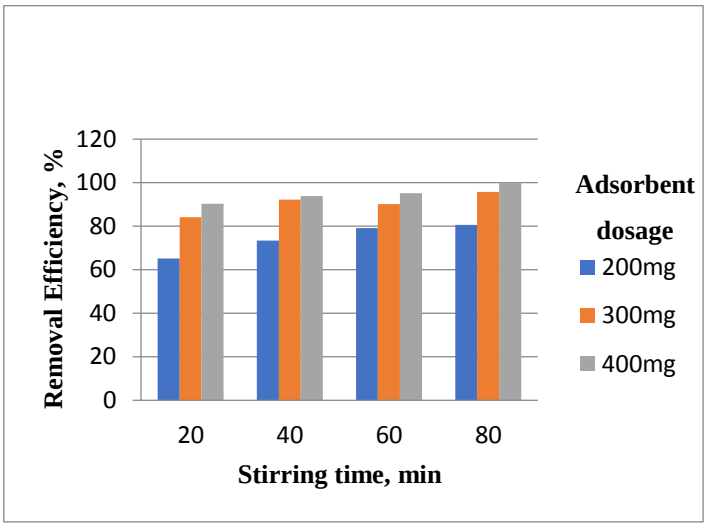

Fig 1: Effect of FeO NPs for removal of RG-19A at pH 9

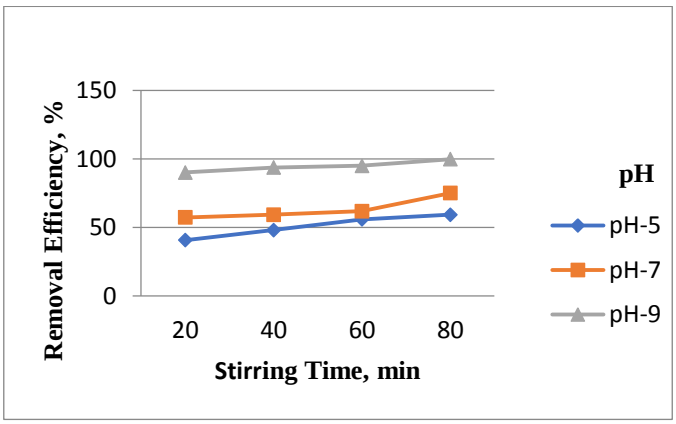

Fig 2 : Effect of pH of RG-19A with FeO NPs (AD 400 mg)

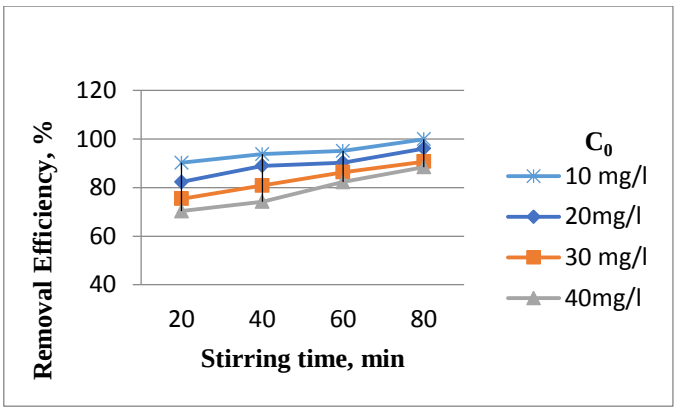

Fig .3 : Effect of Initial Concentration of RG-19A with FeO NPs (AD 400 mg)

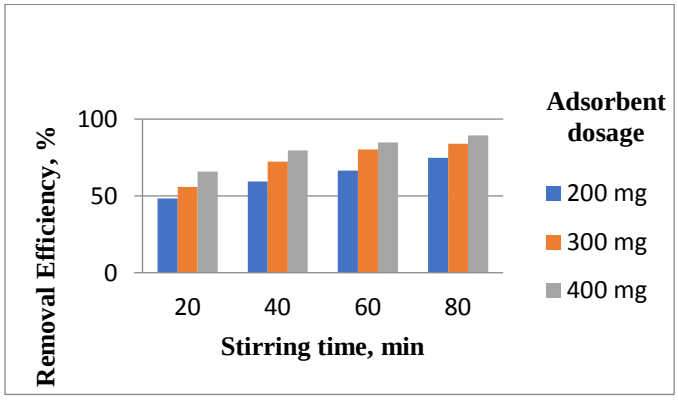

Fig 4 : Effect of FeO NPs for removal of DY-12 at pH 7

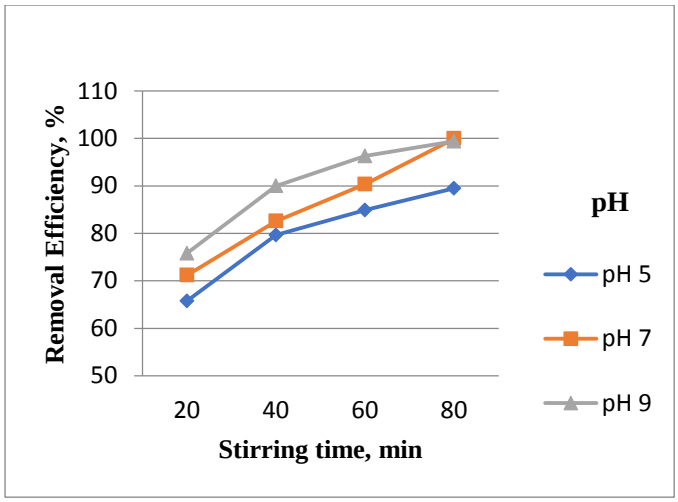

Fig 5: Effect of pH of DY-12 with FeO NPs (AD 400 mg)

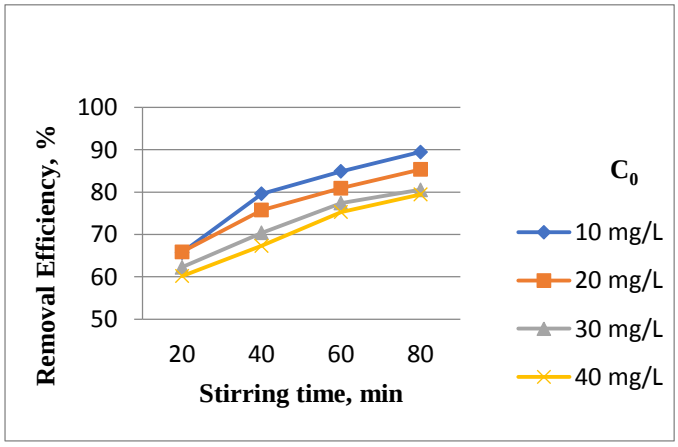

Fig 6 : Effect of Initial Concentration of DY-12 with FeO NPs (AD 400 mg)

4. CONCLUSIONS

By adsorbent synthesize, investigate feasibility of removing synthetic colored samples these experiments war carried. In chapter 4 the experimental analysis and observation data are presented. Below conclusions have been drawn based on performance evaluation of the study.

- It is concluded that Direct dyes maximum decolorization efficiency occurs in neutral pH range, and Reactive dyes maximum removal efficiency occurs in alkaline pH range.
- It is concluded that the decolorization efficiency of both dyes decreases with increase with initial color concentration.
- It is concluded that removal efficiency of color increases with increasing in adsorbent dosage.
- It is concluded that as removal efficiency of increases with increase in agitation the agitation time increases removal efficiency also increases.
- It is concluded that maximum removal efficiency of direct dye achieved at contact time 80 min, Adsorbent dosage 400 mg, initial dye concentration 10 mg/L and at pH 7.
- It is concluded that maximum color removal efficiency of reactive dye can be achieved under optimum condition of initial dye concentration 10 mg/L, contact time 80 min, adsorbent dosage 400 mg, at pH 9.

4.1 Limitations of Present Study

Generally textile industry effluent will be containing mixed colours and of various concentrations, therefore in practicsl sense potential of adsorbent in treating actual effluent is to be studied for optimum conditions. The studies were carried out for selected range of variables, conclusions and inferences are drawn considering the best out these variables. However the refined optimization of variables experimentation is he limitation in present setup.

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