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ADSORPTION OF REACTIVE DYE FROM AQUEOUS SOLUTION BY USING INDUSTRIAL FLY ASH

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Abstract:
Now a days, theneed of water is essential day by day, thus the water we use daily gets polluted due to various factors. Among the polluting factors, textile industry waste water plays an important role. The dye waste water released from them are highly harmful to aquatic organisms, humans and the environment.This research is on the method of decolarization from this waste water using industrial fly ash and efficiency of fly ash for removal of reactive dyes from water. Thus, removal of color from reactive dyes such as Yellow DSR, Blue BB, CFL Green 100, Orange CL-3R dye waste water using fly ash by adsorption method of polluted water. The batch adsorption studies of effect of dye, effect of dye concentration (0.2 g,0.4 g,0.6 g,0.8 g,1.0 g/L), effect of adsorbent dose (0.1 g,0.5 g,1.0 g,1.5 g,2.0g, 2.5 g), effect of mixing time (5,10,15 mins), The adsorbent chemical composition was analysed using XRF and also the removal efficiency of the adsorbent was determined by using UV-Visible spectrophotometer. The fly ash, color removal efficiency is high.

Key words: Reactive dyes, Fly ash, XRF, Waste Water, UV-Vis.

1.Introduction:

In today ‘s era, pure is getting less and less. The development of human Civilization, population growth and their needs are increasing according to their time. They have not been able to fulfil them till date. The basic needs of man are food, clothing and shelter. In this clothing is very important and earlier they were basic for a man. But today it has become a luxury for a man beyond that basic. So, the clothes we want to wear are not easily available to us. There are many factory processes behind them. These industries play a major role globally. In this way, not only the population increases, but also the industries increase. The textile industry plays part in the economy of several countries around the world [1]. The activities of these factories and the wastes they emit pollute the natural factors such as land, water and air. The water we drink every day is not pure, it is a mixture of many industrial wastes. Textile companies, dye manufacturing industries, paper and pulp mills, tanneries, electroplating factories, distilleries, food companies and a host of other industries discharge colored waste water which are released into nearby land or rivers without any treatment[2].The main sources of wastewater generated by the textile industry originate from the washing and bleaching of natural fibers and from the dyeing and finishing steps [3].Among these dyes are toxic and are the major contributory factor. Waste water from textile industries containing dyes is one of the major sources of pollutants causing contamination of water resources. due to large number of textile industries in various areas, effluent dyes are contaminating the water resources and creating a water pollution on massive scale [4]. These dye wastes are a major source of pollution globally. Over 70,000 tons of approximately 10,000 types of dyes and pigments are produced annually throughout the world, of which about 20-30% are wasted in industrial effluent during textile dyeing and finishing process [5].Today there are more than 10,000 dyes available commercially ,dyes have a synthetic origin and complex aromatic molecular structures ,which make them more stable and more difficult to bio degrade &toxic[6] .These dyes are not easily biodegradable and have a huge impact on the environment .Not only that but it is also highly toxic to humans. Direct discharge of textile industry wastewater, into the sewage or in the environment causes the sludge formation layers with containing fiber, dyes have the property of carcinogenic and mutagenic and cause to allergies and skin problems too [7]. The dyes are classified many types, the namely anionic dyes (direct, acid, reactive), Cationicdyes (basic dyes), non-ionic dyes (disperse dyes) [8]. Also, reactive

dyes are chemically stable and are therefore inadequately treated by the conventional treatment works. Reactive dyes are the most common dyes used due to their advantages, such as bright colours, excellent colour fastness and ease of application [9]. Large quantities of reactive dyes are utilised by the textile industry. Mainly due to their extensive application in the dyeing of cotton, about 20-30% of all of the dyestuffs used worldwide are reactive dyes [10]. The wastewaters of textiles are incredibly poisonous and cancerous, the colors and dyes trigger severe ecological issues as they absorb the dissolved oxygen and dismantle flora and fauna. Neurologic and respiratory diseases, nasal sinusitis and psoriasis, infectious melanoma of interaction, adult neurogenesis, teratogenicity, cancer, and genotoxicity are caused by reactive dyes[11].Thus ,toxic dyes are used in many industries .The small scale industries that use them discharge the waste water directly into natural sources such as rivers and lakes without treatment due to lack of management facilities .Researches have also made various efforts to easily purify water from dye water and are conducting many researches using various methods to help small scale industries .Some of those methods are ,A number of methods can be used to remove this dye from waste water; oxidation, ozonation, coagulation and flocculation, filtration, adsorption on activated carbon. [12] The chemical coagulation process effectively decolorizes insoluble dyes, but it fails to work well with soluble dyes. Chemical oxidation is effective, but the oxidant requirements are very high and thus expensive. Photochemical degradation in aqueous solution is likely to progress slowly, as synthetic dyes are, in principle designed to exhibit high stability to light. Although biological treatment processes remove BOD, COD, and suspended solids to some extent, they are largely ineffective in removing color from wastewater, as most dyes are toxic to the organisms used in such processes. However, all of these methods suffer from one or other limitations, and none of them were successful in completely removing the color from wastewater. These technologies do not also show significant effectiveness or economic advantage. Low-cost treatment methods have, therefore, been investigated for a long time. Adsorption has been used extensively in industrial processes for separation and purification[13]and otherwise adsorption is very cheap and effective compared to other methods[12].Thus color has been removed from different types of dye water using the adsorption method .As such, some of the materials used are Charcoal [2], Fullers earth [3,11], Activated bentonite clay [4], Eggshell[7], Posidonia Oceania and Oil palm ash [9],Egg shell and its membrane [10], Egg shell powder [12], Orange peel [14], Banana peel [15], Rice husk[16],Neem leaves[17], Neem husk[18], Saw dust [19], Apple pomace and Wheat straw[20],Coir pith[21],banana stem [22], Bentonite[23], Waste red mud [24],Peat[25], Banana pith[26], Palm kernel fibers [27], wood pallets [28], Sugarcane dust [29],,Industrial waste [30],Shale oil ash [31],Coffee waste[32]and Fly ash[5,6,13].In this research investigates the efficiency of color removal from waste water of reactive dyes used in dye factories by using fly ash from industrial boilers and their efficiency .

2.MATERIALS AND METHODS;

2.1 Preparation of adsorbent:

Fly ash was used for this experiment. Fly ash was obtained from the IDM Mill at Erode, the obtained fly ash was washed several times using distilled water, dried using a hot air oven at 80◦C for 2 hours, and then filtered to have fine particles. The filtered fly ash was collected and they were analyzing the decolorization test for the dye at various weight.

2.2 Preparation of dye solution:

In this study, Yellow DSR, Blue BB, CFL Green 100 and Orange CL-3R dye were dissolved in water and used as dye effluent samples. These dyes were taken in different weights and dissolved in 1 L of water and used as dye effluent samples, all these dyes were retrieved from IDM mill. The dye was then dissolved in water and its absorbency value was measured using a UV-visible spectrophotometer-Evolution 201 (Thermo Fisher Scientific) to measure its wavelength.

2.3 Batch Adsorption studies:

2.3.1 Effect of dye:

Reactive dyes of only few colors used in this study are yellow DSR, Blue BB, CFL Green 100, Orange CL-3R

2.3.2 Effect of dye concentration:

In this research the dyes were dissolved in water at various levels which were up to 0.2g,0.4g,0.6g,0.8g,1.0g /L in same water pH.

2.3.3 Effect of adsorbent dose:

In this study fly ash reacting with dyestuff was used in different weights. these fly ashes were all fine particles and only weight was changed. The weight was 0.1g,0.5g,1.0g,1.5g,2.0g,2.5g.

2.3.4 Effect of time:

Here in this research, the mixing time has an important effect in this study. Efficiency varies over the mixing time Fly ash is mixed with dye solution of short period at three different times during which they are tested 5min,10min,15min.

2.4 Experimental method:

In this study, the stock solution of 0.2 g f dye was dissolved in 1L of water and 50 ml was used as working solution. 50 ml of dye solution was taken in a taken in a 250 ml conical flask and 1.0 g of fly ash was added to them and mixed at 150rpm for 10 minutes using Orbital Shaker. This was done for each such dyes and it's worked on effect of mixing time, dye concentration, dye, adsorbent dose. then the fly ash was separated from the solution by using a centrifuge at 8000 rpm for 5 minutes and separated separately. The colour absorbed value of the extracted solution was calculated using a UV-Vis spectrophotometer. All these experiments were carried out at room temperature (30◦C) and its adsorbed percentage was calculated using following equation.

$$\text{Percentage of removal (\%)} = \frac{Co - C}{Co} * 100$$

Were,

Co - initial concentration (mg/L)

C - final concentration (mg/L)

3. RESULTS AND DISCUSSION:

3.1 Maximum wavelength:

The wavelength of the four dyes under study were measured using a UV-Visible spectrophotometer - Evolution 201 (Thermo Fisher Scientific). The wavelength of the dyes the analyzed are Yellow DSR dye wavelength 410 nm, Blue BB dye wavelength 595 nm, CFL Green 100 dye wavelength 400 nm and Orange CL-3R dye wavelength 500 nm.

3.2 Elemental Analysis:

The fly ash used as adsorbent in the experiment contains various chemicalscomposition, by the action of those chemicals, the fly ash can be used to remove the dye color from the water. The X-Ray Fluorescence is used to determine the amount of chemical composition in the ash. They are tabulated as follows,

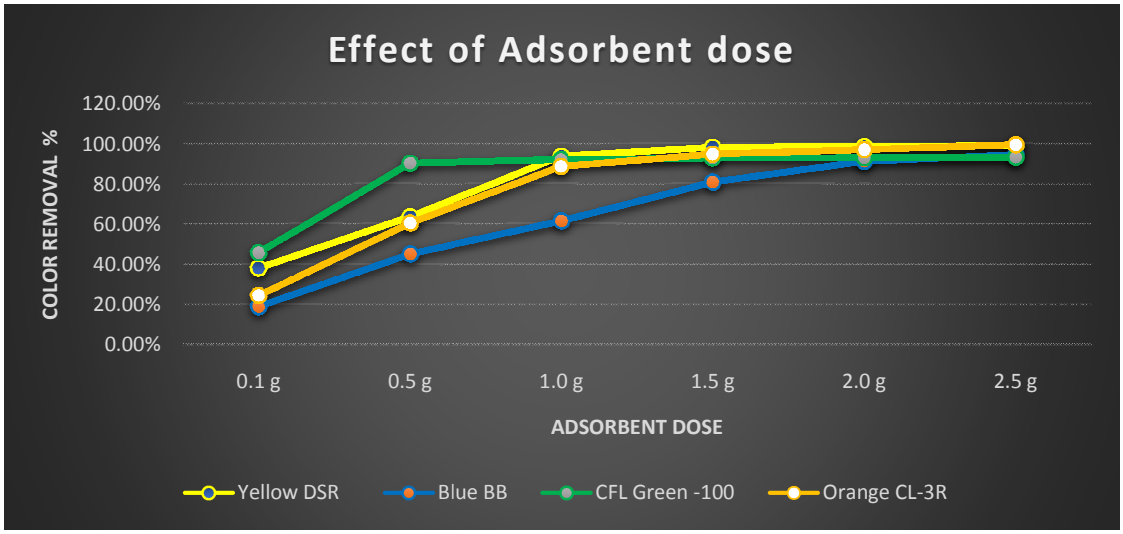
Element	PPM
Ca	15.43%
Ti	640
Mn	584
Fe	6.077%
Cu	2780
Zn	569
As	32

Sr	19
Zr	43
Ag	6
Sn	24
Ba	626

3.3 Effect of Adsorbent dose:

Adsorbent dose experiment, when more fly ash is added ,to the dye solution ,its efficiency is increased ,0.2 g/l of concentrated dye was dissolved in water and 50 ml taken from it as working solution ,and the amount of fly ash added to it was 0.1 g,0.5 g,1.0 g,1.5 g,2.0 g, and 2.5 g in different weights such as grams are used for research the mixing time is constant for 5 min .A maximum of 90%and above colour removal of the dye solution is achieved when 2.0 g and 2.5 g of fly ash is prevent ,and less than 40 %colour removal is achieved when a minimum of 0.1 g of fly ash is added .In effect of adsorbent dose ,the colour removal percentage in Yellow DSR dye was 98.91% ,Blue BB dye was 94.35%,CFL green -100 dye was 93.28% and Orange CL-3R dye was 99.31%.Fly ash had an excess on Orange CL-3R from both these dye solutions. The effluent sample treated by fly ash, the color removal percentage and after effluent absorbance value are tabulated,

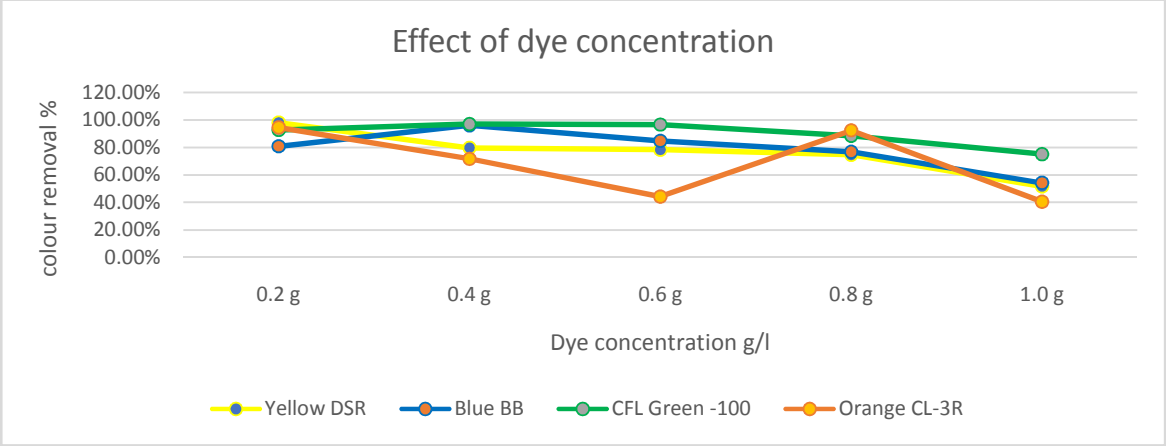
S.no	Dye	Adsorbent Dose (g/L)	% Of colour removal	Absorbance value
1.	Yellow DSR	0.1 g	37.87%	1.540
		0.5 g	63.49%	0.905
		1.0 g	93.66%	0.157
		1.5 g	98.14%	0.046
		2.0 g	98.46%	0.038
		2.5 g	98.91%	0.027
2.	Blue BB	0.1 g	18.75%	0.979
		0.5 g	44.97%	0.663
		1.0 g	61.41%	0.465
		1.5 g	80.82%	0.231
		2.0 g	91.12%	0.107
		2.5 g	94.35%	0.068
3.	CFL GREEN 100	0.1 g	45.55%	0.649
		0.5 g	90.18%	0.117
		1.0 g	92.03%	0.095
		1.5 g	92.78%	0.086
		2.0 g	92.95%	0.084
		2.5 g	93.28%	0.080
4.	Orange CL–3R	0.1 g	24.16%	1.986
		0.5 g	60.36%	1.038
		1.0 g	88.50%	0.301
		1.5 g	94.69%	0.139
		2.0 g	96.90%	0.081
		2.5 g	99.31%	0.018



3.4 Effect of Dye concentration:

The effect of dye concentration, from 0.2 g,0.4 g,0.6 g,0.8 g,1.0 g/l dye dissolved in water and used in the study when fly ash added to it the efficiency decreases according to its slope low concentration solution has high efficiency and concentration has low efficiency fly ash in this study used in constant weight of 1.5 g mixing time was constant of 5 min. At the end of the experiment efficiency of all the dyes under study decreases depending on its concentration. Maximum 98.14% color was removed from the yellow DSR dye solution at 0.2 g concentration when fly ash was added to the dye water. A minimum of 40.50% color is removed from 1.0 g concentration of Orange CL-3R. At some points the efficiency is upward and downward.

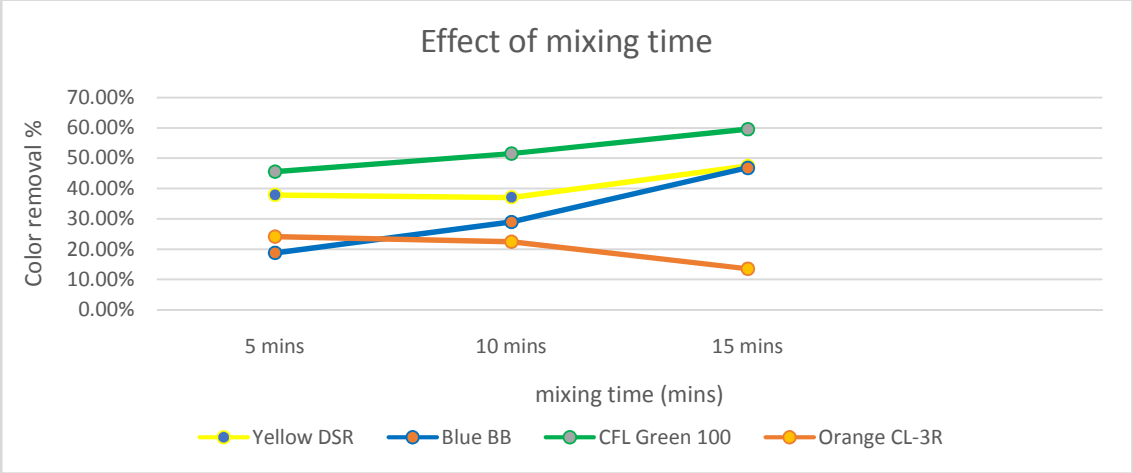
S.no	Dye	Dye concentration (g/L)	% Of colour removal	Absorbance value
1.	Yellow DSR	0.2 g	98.14%	0.046
		0.4 g	79.85%	0.686
		0.6 g	78.44%	0.756
		0.8 g	74.75%	0.963
		1.0 g	51.74%	2.186
2.	Blue BB	0.2 g	80.82%	0.231
		0.4 g	96.14%	0.109
		0.6 g	84.81%	0.468
		0.8 g	76.81%	0.765
		1.0 g	54.17%	1.953
3.	CFL GREEN 100	0.2 g	92.78%	0.086
		0.4 g	97.09%	0.074
		0.6 g	96.67%	0.086
		0.8 g	88.50%	0.303
		1.0 g	75.03%	0.698
4.	Orange CL–3R	0.2 g	94.69%	0.139
		0.4 g	71.77%	0.811
		0.6 g	44.29%	1.684
		0.8 g	92.56%	0.244
		1.0 g	40.50%	2.089



3.5 Effect of mixing time:

As mentioned earlier in this study, mixing time affects its efficiency. In this study, the adsorbent and solution interaction period working on different time ,5 min,10 min, 15 min, initial dye concentration 0.2 g/l initial adsorbent dose 0.1g /50 ml. In this time -dependent study, the efficiency of each dye varied with the length of time it was in contact with fly ash. Yellow DSR, Blue BB, CFL Green -100 the excess color is removed from the dye solution by prolonged contact of fly ash with the dye solution. But, only a small amount of color is removed when fly ash is exposed to Orange CL-3R dye solution for a long time. But more color is removed when the fly ash is in contact with the dye solution for only a short time. Of this, maximum 59.56%of the color was removed by contact with fly ash CFL Green 100 solution for 15 min and minimum 13.47% colour was removed by contact with fly ash Orange CL-3R for 15 min in dye solution.

S.no	Dye	Mixing Time (mins)	% Of colour removal	Absorbance value
1.	Yellow DSR	5 mins	37.87%	1.540
		10 mins	37.07%	1.560
		15 mins	47.43%	1.303
2.	Blue BB	5 mins	18.75%	0.979
		10 mins	28.96%	0.856
		15 mins	46.80%	0.641
3.	CFL GREEN 100	5 mins	45.55%	0.649
		10 mins	51.51%	0.578
		15 mins	59.56%	0.482
4.	Orange CL–3R	5 mins	24.16%	1.986
		10 mins	22.45%	2.031
		15 mins	13.47%	2.266



3.6 Effect of dye:

In this study, the efficiency of the four dyes taken, yellow DSR and Blue BB, CFL Green 100, Orange CL-3R is defined as follows. For all four dyes solutions used in the study, the efficiency varied with the dyes when using fly ash. A maximum of 99.71% decolorization and a minimum of 7.83% decolarization were achieved when using fly ash with yellow DSR dye solution. Maximum 97.87% Saturation and minimum 8.43% color removal when used with Blue BB dye solution. Maximum 99.60% color removal and minimum 1.25% color removal when used with CFL Green 100 dye solution. Maximum99.31% color removal and minimum 0.45% color removal when used with Orange CL-3R solution. Absorbance value and colour removal percentage were obtained after treated of dye solutions fly ash as below,

Dye concentration (g/L) & (Absorbance Value)	Mixing time (mins)	Adsorbent dose					
		0.1g	0.5 g	1.0 g	1.5 g	2.0 g	2.5 g
0.2 g/l (2.479)	5	1.540 37.87%	0.905 63.49%	0.157 93.66%	0.046 98.14%	0.038 98.46%	0.027 98.91%
	10	1.560 37.07%	1.025 58.65%	0.223 91.00%	0.070 97.17%	0.040 98.38%	0.040 98.38%
	15	1.303 47.43%	0.668 73.05%	0.211 91.48%	0.070 97.17%	0.033 98.66%	0.021 99.15%
0.4 g/l (3.406)	5	3.106 8.80%	2.855 16.17%	1.637 51.93%	0.686 79.85%	0.441 87.05%	0.208 93.89%
	10	3.013 11.53%	2.927 14.06%	2.189 35.73%	0.349 89.75%	0.156 95.41%	0.069 97.97%
	15	3.935 13.82%	2.225 34.67%	1.319 61.27%	0.657 80.71%	0.042 98.76%	0.021 99.38%
0.6 g /l (3.507)	5	2.987 14.82%	2.646 24.55%	1.316 62.77%	0.756 78.44%	0.107 96.94%	0.012 99.65%
	10	2.916 16.85%	2.526 27.97%	1.614 53.97%	0.345 90.16%	0.045 98.71%	0.010 99.71%
	15	2.765 21.15%	2.502 28.63%	1.038 70.40%	0.154 95.60%	0.077 97.80%	0.037 98.94%
	5	3.516 7.83%	2.906 23.82%	2.251 40.96%	0.963 74.75%	0.369 90.32%	0.216 94.33%

0.8 g/l (3.815)	10	3.424 10.24%	3.128 18.00%	2.820 26.08%	1.395 63.43%	0.603 84.19%	0.192 94.96%
	15	3.277 14.10%	2.937 23.01%	1.502 60.62%	0.970 74.57%	0.629 83.51%	0.092 97.58%
1.0 g/l (4.530)	5	3.397 25.01%	3.173 29.95%	2.803 38.12%	2.186 51.74%	0.403 91.10%	0.059 98.69%
	10	3.482 23.13%	2.968 34.48%	2.656 41.36%	1.991 56.04%	0.245 94.59%	0.128 97.17%
	15	3.438 24.10%	2.954 34.79%	2.535 44.03%	1.543 65.93%	0.972 78.54%	0.200 95.58%

Yellow DSR dye treated with fly ash

Dye concentration (g/L) & (Absorbance Value)	Mixing time (mins)	Adsorbent dose					
		0.1g	0.5 g	1.0 g	1.5 g	2.0 g	2.5 g
0.2 g/l (1.205)	5	0.979 18.75%	0.663 44.97%	0.465 61.41%	0.231 80.82%	0.107 91.12%	0.068 94.35%
	10	0.856 28.96%	0.654 45.72%	0.392 67.46%	0.114 90.53%	0.094 92.19%	0.069 94.27%
	15	0.641 46.80%	0.503 58.25%	0.297 75.35%	0.119 90.12%	0.099 91.78%	0.036 97.01%
0.4 g/l (2.829)	5	2.455 13.22%	0.904 54.82%	0.404 85.71%	0.109 96.14%	0.094 96.67%	0.060 97.87%
	10	2.159 23.68%	0.717 74.65%	0.448 84.16%	0.319 88.72%	0.252 91.09%	0.162 94.27%
	15	2.578 8.87%	1.417 49.91%	0.338 88.05%	0.227 91.97%	0.191 93.24%	0.169 94.02
0.6 g /l (3.081)	5	2.638 14.37%	2.584 16.13%	1.208 60.79%	0.468 84.81%	0.435 85.88%	0.333 89.19%
	10	2.563 16.81%	2.510 18.53%	1.636 46.90%	1.018 66.95%	0.234 92.40%	0.092 97.01%
	15	2.821 8.43%	1.592 48.32%	0.611 80.16%	0.448 85.45%	0.234 92.40%	0.144 95.32%
0.8 g/l (3.300)	5	2.964 31.53%	2.652 19.63%	2.236 32.24%	0.765 76.81%	0.249 92.45%	0.166 94.96%
	10	2.800 15.15%	2.486 24.66%	1.813 45.06%	0.537 83.72%	0.275 91.66%	0.264 92%
	15	2.792 15.39%	2.667 19.18%	2.613 20.81%	0.724 78.06%	0.194 94.12%	0.188 94.30%
1.0 g/l (4.262)	5	2.918 31.53%	2.754 35.38%	2.684 37.02%	1.953 54.17%	1.486 65.13%	0.579 86.41%
	10	3.041 28.64%	2.881 32.40%	2.776 34.86%	1.953 54.17%	1.924 54.85%	0.552 87.04%
	15	2.989 29.86%	2.919 31.51%	2.837 33.43%	1.584 62.83%	0.634 85.12%	0.223 94.76%

Blue BB dye treated with fly ash

Dye concentration (g/L) & (Absorbance Value)	Mixing time (mins)	Adsorbent dose					
		0.1g	0.5 g	1.0 g	1.5 g	2.0 g	2.5 g
0.2 g/l (1.192)	5	0.649 45.55%	0.117 90.18%	0.095 92.03%	0.086 92.78%	0.084 92.95%	0.080 93.28%
	10	0.578 51.51%	0.286 76.00%	0.105 91.19%	0.065 94.54%	0.057 95.21%	0.046 96.14%
	15	0.482 59.56%	0.152 87.24%	0.122 89.76%	0.093 92.19%	0.068 94.29%	0.066 94.46%
0.4 g/l (2.544)	5	1.464 42.45%	0.839 67.02%	0.158 93.78%	0.074 97.09%	0.052 97.95%	0.033 98.70%
	10	1.374 45.99%	0.610 76.02%	0.385 84.86%	0.314 87.65%	0.152 94.02%	0.112 95.59%
	15	1.409 44.61%	0.539 78.81%	0.173 93.19%	0.161 93.67%	0.141 94.45%	0.108 95.75%
0.6 g /l (2.587)	5	1.019 60.61%	0.112 95.67%	0.099 96.17%	0.086 96.67%	0.082 96.83%	0.073 97.17%
	10	1.697 34.40%	0.200 92.26%	0.032 98.76%	0.029 98.87%	0.027 98.95%	0.024 99.07%
	15	2.181 15.69%	0.065 97.48%	0.019 99.26%	0.018 99.30%	0.013 99.49%	0.012 99.53%
0.8 g/l (2.635)	5	2.117 19.65%	1.434 45.57%	0.618 76.54%	0.303 88.50%	0.265 89.94%	0.100 96.20%
	10	2.039 22.61%	1.155 56.16%	0.570 78.36%	0.143 94.57%	0.075 97.15%	0.036 98.63%
	15	2.114 19.77%	1.082 58.93%	0.267 89.86%	0.131 95.02%	0.109 95.86%	0.072 97.26%
1.0 g/l (2.796)	5	2.761 01.25%	1.965 29.72%	1.321 52.75%	0.698 75.03%	0.033 98.81%	0.025 99.10%
	10	2.503 10.47%	1.613 42.31%	0.338 87.91%	0.086 96.92%	0.022 99.21%	0.011 99.60%
	15	2.368 15.30%	0.629 77.50%	0.136 95.13%	0.039 98.60%	0.019 99.32%	0.014 99.49%

CFL green100

Dye concentration (g/L) & (Absorbance Value)	Mixing time (mins)	Adsorbent dose					
		0.1g	0.5 g	1.0 g	1.5 g	2.0 g	2.5 g
0.2 g/l (2.619)	5	1.986 24.16%	1.038 60.36%	0.301 88.50%	0.139 94.69%	0.081 96.90%	0.018 99.31%
	10	2.031 22.45%	0.929 64.52%	0.378 85.56%	0.089 96.60%	0.066 97.47%	0.053 97.97%
	15	2.266 13.47%	0.884 66.24%	0.225 91.40%	0.147 94.38%	0.068 97.40%	0.046 98.24%
0.4 g/l (2.873)	5	2.492 13.26%	2.063 28.19%	1.267 55.89%	0.811 71.77%	0.632 78.00%	0.096 96.65%
	10	2.673 6.96%	2.168 24.53%	0.969 66.27%	0.560 80.50%	0.411 85.69%	0.318 88.93%
	15	2.805 2.36%	2.009 30.07%	1.510 47.44%	0.563 80.40%	0.525 81.72%	0.163 94.32%
0.6 g /l (3.023)	5	2.856 5.52%	2.738 9.42%	2.040 32.51%	1.684 44.29%	1.727 42.87%	0.973 67.81%
	10	2.910 3.73%	2.372 21.53%	1.329 56.03%	1.217 59.74%	0.865 71.38%	0.233 92.29%
	15	2.978 1.48%	2.588 14.38%	0.661 78.13%	0.454 84.98%	0.248 91.79%	0.203 93.28%
0.8 g/l (3.280)	5	2.890 11.89%	2.482 24.32%	1.221 62.77%	0.244 92.56%	0.214 93.47%	0.173 94.72%
	10	3.080 6.09%	2.668 18.65%	1.142 65.18%	0.559 82.95%	0.291 91.12%	0.168 94.87%
	15	2.829 13.75%	2.788 15.0%	1.215 62.95%	1.014 69.08%	0.290 91.15%	0.255 92.22%
1.0 g/l (3.511)	5	3.495 0.45%	2.838 19.16%	2.651 24.49%	2.089 40.50%	0.900 74.36%	0.888 74.70%
	10	2.973 15.32%	2.779 20.84%	2.329 33.66%	1.371 60.95%	1.068 69.58%	0.348 90.08%
	15	3.376 3.84%	2.701 23.07%	1.457 58.50%	1.069 69.55%	0.730 79.20%	0.369 89.49%

Orange CL-3R

4.Conclusion:

Reactive dyes yellow DSR, Blue BB, CFL Green 100, Orange CL -3R were decolorized from dye wastewater using fly ash in a study to decolorize all dyes from water, even with the shortest time interval of 5minutes to 15 minutes using 2.5 g of adsorbent, more than 80% of all dye concentrations even from four dye effluent samples were color removed. More dyes color removal from wastewater is

also being investigated. Out of these four dyes, the maximum Yellow DSR with 2.5 g of adsorbent used was 99.71% color removal within 10 minutes in 50 ml working dye solution of 0.6 g/l concentrated dye. The lowest color removal was 0.45% ,50 ml of working solution of dye at concentration of 1.0 g/l was decolorized from Orange CL-3R within 5min of using the 0.1 g of adsorbent. Color adsorbed fly ash and its disposal method were not tested in this study. But as mentioned by Chandrasekaran [33]earlier, the method of disposal of color adsorbed ash is concreate used to make. With this method the dye adsorbed ash can be disposed of or reused. This research will be useful for the small-scale industries, where the process of purifying the color of dyes from the waste water using the industrial waste from that industry will benefit them in less cost and less time.

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