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Microwave Assisted Synthesis of Some Azo Disperse Dyes part 3: Dye bath Reuse in Dyeing of Polyester

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Abstract

Due to the environmental risks that humans may be exposed to, whether from nature or industrial waste, in this study the water resulting from the dyeing bath was treated with sugarcane bagasse to reduce damage to the environment. Waste water of dye bath was also used to dye the polyester fabrics.

Keywords:waste water treatment; sugarcane bagasse; dyebath reuse.

1. Introduction

Water is the important resources for humanity are polluted on a daily basis due to pollution resulting from various production processes, the most important of which is industrial waste [1-3].Textile industries and dyeing processes are considered among the significant sources of pollution due to the amount of spent dyes and chemicals needed for the dyeing process that are produced as waste from the dyeing process [4, 5].Untreated liquid colored waste before discharge it to any watercourse is a major cause of water pollution, and therefore it must be treated to reduce pollution resulting from it [6].One of the most important methods of treating wastewater from dyeing processes is the use of bio-adsorbents, such as active carbon [7-9]. Due to the high price of activated carbon and the huge amount of water to be treated, less costly and bio-absorbing alternatives have been developed, such as cellulose, sawdust and sugar cane bagasse [10, 11]. It had been reported that sugar cane bagasse can be used as a bio-absorbent material as it was found to have a high ability to absorb colors from colored wastewater [12]. On the other hand, the environmental damage resulting from dyeing residues was reduced by reusing the dyeing bath after its renewal, and the dyeing bath must contain residues of dyes whose properties do not change after being used in dyeing from the first time [13, 14].

2. Materials and Methods

General method for the Synthesis of Disperse Dyes 1-9which applied in this survey had been Annotated In our antecedent research we published [15].

Fabric

Scoured and bleached 100% polyester fabric was supplied by El-Mahalla El-Kobra Company, Egypt. The fabrics were scoured in aqueous solution having a liquor ratio of 1:50 and containing 2 g/L of nonionic detergent solution (Hostapal; Clariant, Swiss) and 2 g/L of Na_2CO_3 at 50 °C for 30 min to remove waxes and impurities, then rinsed thoroughly in cold tap water, and dried at room temperature.

Dyeing process

Dyeing procedure by using microwave oven had been described in our antecedent research we published [16].

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Color Measurements

Color fastness to light

The light fastness test was carried out in accordance with the ISO 105-B02:1988 test method 9, using a carbon arc lamp and continuous light for 35 h. The effect on the color of the tested samples was recorded by reference to the blue scale for color change.

Dye bath waste water treatment

Dyebath reuse

Dye bath which resulting from first dyeing have been adjusted to pH4.5 then used as a new dye bath at the same conditions of first dyeing that was published before [16].

Using of sugarcane bagasse

The sugar cane bagasse was dried at room temperature and it was further triturated in an industrial blender. Dye waste water were treated by wasted sugarcane pulp using 20 g / L, pH (4.5). Sample was dissolved in 3 ml acetic acid and then diluted by 7 ml water. Sample was agitated mechanically by SANYO GALLENKAMP- SWP-400-010N.TestsampleswereexaminedinUV– VIS Spectrophotometer to check the initial % absorbance in order to measure the color of the solution after then second dyeing process.

3. Results and Discussion

The Arylazopyrazolopyrimidinones disperse dyes **1-9** were applied fordyeing polyester fabrics, their chemical structures are shown in figure 1

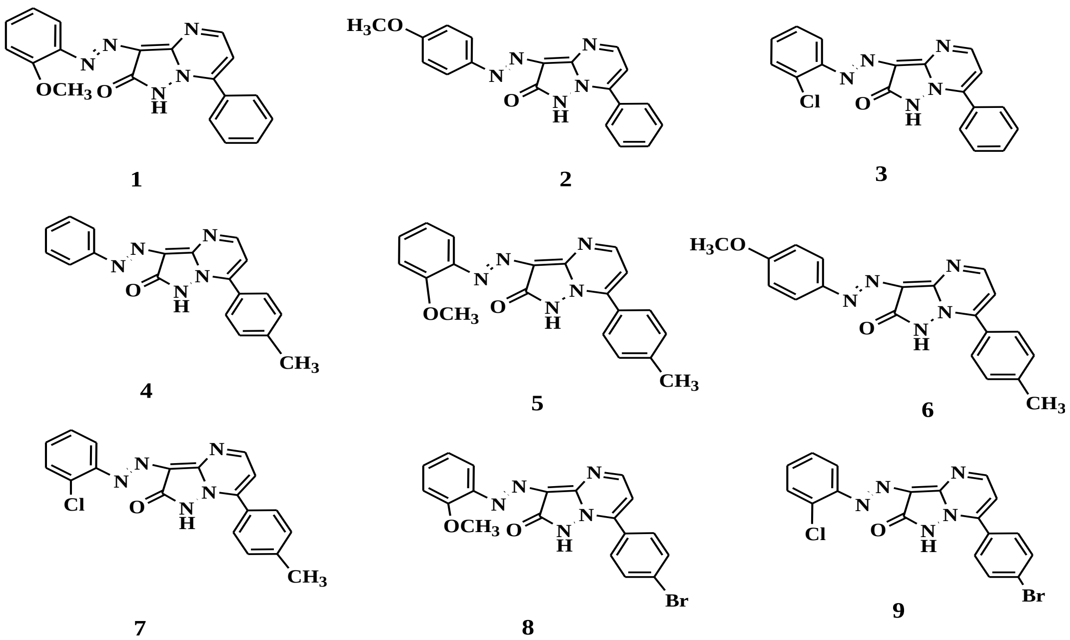

Figure 1. Chemical structure of the disperse dyes

Treatment of dyeing waste water

Dyebath reuse

Table 1 shows that waste water can be treated by reuse it as dye bath where dye be absorbed by textile and yield good results for K/S even for 2nd dyeing process for the dye bath. And Table 1 shows that Re-dyeing using dye waste water can remove large amount of dye from dye waste water where fabric has very good color intensity.

Fastness properties

From table 2, it clearly that preparing waste dye bath as a new dye bath did not effect on fastness properties. Where polyester fabric has very good fastness for washing, perspiration, rubbing, and sublimation fastness, while show moderate fastness for light.

Table 1: Reusing of dye bath waste water in dyeing process

Dye No	L*	*a**	*b**	*C**	*h**	K/S Dye reused
1	67.83	15.55	53.24	55.46	73.71	4.48
2	65.06	20.48	67.93	70.95	23.22	12.67
3	73.19	5.15	30.06	30.50	80.28	3.28
4	70.51	4.11	71.47	71.59	86.71	12.09
5	69.81	8.13	66.42	66.92	83.02	8.62
6	74.98	- 6.14	43.16	43.59	98.10	2.53
7	69.25	12.12	47.33	48.68	75.46	3.27
8	72.54	6.43	33.25	33.86	79.06	1.53
9	76.27	- 1.96	18.64	18.74	96.02	0.71

Table2. Fastness properties of disperse dyes on the polyester fabric

Dyeing No	Washing fastness			Perspiration fastness						Rubbing fastness		Sublimation fastness		Light fastness
				Acidic			Alkaline							
	Alt	SC	SW	Alt	SC	SW	Alt	SC	SW	Wet	Dry	180 °C	210 °C	
1	5	5	5	4-5	4-5	4-5	5	5	5	5	5	4-5	4	2-3
2	5	5	5	5	5	5	5	5	5	5	5	4-5	3-4	2
3	5	5	5	5	5	5	5	5	5	5	5	4	4	2-3
4	5	5	5	5	5	5	5	5	5	5	5	3	2-3	3-4
5	5	5	5	5	4-5	4-5	5	5	5	5	5	4	4	2
6	5	5	5	5	5	5	5	5	5	5	5	4	3-4	3-4
7	5	5	5	5	4-5	4-5	5	5	5	5	5	4	4-5	3
8	5	5	5	5	5	5	5	5	5	5	5	4-5	4-5	3-4
9	5	5	5	5	5	5	5	5	5	5	5	4-5	4-5	3

Washing fastness

The dyes under investigation showed very good fastness against washing, and this may be due to the fact that these dyes have the ability to spread inside the fabric and be entangled to it by different forces such as Van der Waal.

Rubbing and Perspiration fastness

From Table. 2 it is clear that dyes **1-9** have very good fastness to rubbing and perspiration, and this may be due to the fact that these dyes are spread well inside the fabric and perhaps because the dye particles are relatively large.

Sublimation fastness

Dyes **1-9** shows a variation in sublimation fastness from mordant to very good fastness for sublimation it may be refer to intermolecular interactions which have an effect on the sublimation fastness feature

Using of sugarcane bagasse

It has been reported that treating dyeing baths by adsorbing method is one of the most important techniques, as dyes can be completely removed from the dye bath even if it is not concentrated [17, 18]. From this point of view, sugarcane bagasse has the ability to remove dyes from the dyeing bath, as is evident from the data recorded in Table 3. Table 3 shows sugar cane waste can adsorb large amounts of dye from waste water about 98 % of dye of dye waste water can be absorbed by sugar waste.

Table 3.Removal of dyes using of sugarcane bagasse

Dye No.	% Removal	
	After 20 min.	After 40 min.
1	46.44	92.88
2	9.18	87.35
3	22.36	91.29
4	43.67	99.05
5	11.69	97.50
6	18.72	98.98
7	18.62	98.73
8	60.46	99.28
9	8.35	98.39

Conclusions

The remaining dye bath was used from the first dyeing process, as it gave bright colors and the intensity of the color obtained was very good. The different fastness properties of the woven fabric were also studied, and these results were excellent. Sugar cane bagasse gave excellent results in treating the dyeing bath

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